The Effect of Board Structure and Presence of Female Directors on Corporate Risk Taking in the UK

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy

By

Buthiena Kharabsheh

The University of Liverpool Management School

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Abstract

This study investigates the effects of board structure and the presence of female directors on corporate risk-taking behaviour of UK public firms. The research employs a sample of 589 firms from the non-financial sector and 276 firms from the financial sector listed in the FTSE All-Share Index on the London Stock Exchange over the period 2003-2012. The main objective of this research is thus to examine the effect of board structure characteristics and the presence of female directors on corporate risk taking in UK publicly listed companies. After controlling for three types of endogeneity, i.e. simultaneity, unobserved heterogeneity and dynamic endogeneity, through the application and use of a dynamic panel estimator system GMM, this study finds that board structure and female directors are important determinants of corporate risk taking in the UK.

Board independence and CEO/Chairperson duality are negatively related to corporate risk taking in both the financial and non-financial companies. In addition, the findings indicate that larger boards in the non-financial sector result in lower corporate risk taking whereas no impact of board size was found in the financial sector. While analysing the percentage number of female directors on corporate risk taking, it was revealed that the presence of female directors on corporate boards in the non-financial sector increases the corporate risk taking and thus works in line with shareholders' interests and expectations. Moreover, the study finds that this positive significant effect has a quadratic concave effect on corporate risk taking. However, in the financial sector no significant effect on risk taking is shown by the presence of female directors.

After considering the effect of financial crisis, it was found that the non-executive directors work in line with shareholders' interests and support more risky investments in the pre-crisis period in the non-financial companies. However, the non-executive directors in the financial sector behave in a more conservative way, and negatively affect corporate risk taking in both the pre-crisis and post-crisis periods. Moreover, in both sectors duality is found to be negatively related to corporate risk taking during the crisis period only, with no significant effect found for duality in the pre- and post-crisis periods. Further, the positive effect of female

directors in the non-financial companies appears only in the pre-crisis period. Overall, the findings of this research would be important for the regulators and policymakers responsible for establishing corporate governance regulations for both the financial and non-financial sectors in the UK.

Declaration

I hereby declare that the work and the material contained in this thesis are my own work. I further declare that no part of this work has been previously submitted for a degree qualification in this or any other university.

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Dedication

“I dedicate this work to the soul of my father”

Chapter 1

Overview of the Research

1.1 Introduction and Background

During the last two decades, the international capital markets have witnessed the apparent failures of many large corporations. The collapse of giant American and British corporations such as Enron, WorldCom, Polly Peck, and BCCI has created a special focus on the corporate governance theme. Hence, corporate governance has received more attention and has become a debated subject by academics, observers, regulators and investors (Boyd 1995; Daily and Dalton 1994; Dalton et al. 1998). Moreover, this topic has become an independent research area and is studied in different fields like finance, accounting, management, and law, among others (Denis 2001; Solomon 2010).

The recent financial crisis of 2007-2009, which was described as the worst since the Great Depression, also revealed the weaknesses in corporate governance mechanisms around the world. In light of the recent crisis, many research papers, discussions, and articles try to shed light on its causes. According to Kirkpatrick (2009), the failure in the internal control system, high executive remuneration and poor risk management are viewed as the main causes for the crisis. Pathan (2009), the Walker Report (2009) and Minton et al. (2014), among others, noted that irresponsible managerial risk taking is considered one of the contributors to the recent crisis.

Furthermore, there was a large consensus that the board of directors, which is considered the main internal governance mechanism and is responsible for all the strategic decisions in a firm, was not performing its responsibilities as expected (e.g., Andres and Vallelado 2008; Boyd et al. 2011; Erkens et al. 2012; Hardwick et al. 2011; Ingley and van der Walt 2008). The board of directors was also blamed for not protecting the shareholders' rights and for focusing on the short term rather than on long-term objectives (Erkens et al. 2012). Consequently, most of the corporate

governance codes around the world emphasise the importance of the board of directors, particularly in managing risk.

In the UK, the recent corporate governance code (2010) strongly focuses on board of directors and risk when describing good corporate governance. Section (A.1) in the code states that "*The board's role is to provide entrepreneurial leadership of the company within a framework of prudent and effective controls which enables risk to be assessed and managed*" (UK Corporate Governance Code 2010, p.9). In addition, risk management and the firm's long-term horizon have been added to the core of the 2010 code. For example, long-term horizon, which should be the focus of the board for a firm's success, is mentioned 10 times in the 2010 code compared with five times in the 2008 code.

A large body of corporate governance literature has focused on the composition and structure of boards of directors. The majority of these papers have studied board independence as they compare executive and non-executive directors (Fich 2005; Hermalin and Weisbach 1988; Linck et al. 2008), the relationship between board structure and directors' ownership (Denis and Sarin 1999; Simpson and Gleason 1999), what determines the board size (Boone et al. 2007; Guest 2008; Lehn et al. 2009; Raheja 2005), board structure and directors' pay (Guest 2010), and the effect of board structure on corporate performance (Baysinger and Butler 1985; Dahya and McConnell 2007; Haniffa and Hudaib 2006; Hermalin and Weisbach 1991; Vafeas and Theodorou 1998). Another stream of governance studies has examined the effect of gender diversity on corporate performance (e.g., Adams and Ferreira 2009; Adams and Funk 2012; Campbell and Mínguez-Vera 2008; Erhardt et al. 2003; Kang et al. 2007).

Given this large amount of literature, only a few studies relate the board structure and the presence of female directors to corporate risk taking. The board structure-performance relationship is dominant in the large body of corporate governance literature. Corporate performance is an important aspect that firm shareholders are interested in; however, corporate performance variability is also a fundamental aspect that should be considered (Cheng 2008). Risk is one of the most important components in managerial decision-making that affects the success of the firm (Kim

and Buchanan 2008). Therefore, this study aims to extend this literature and examine how the board structure and the presence of female directors affect corporate risk taking. Nevertheless, before moving on, it is important to start with a brief background to understand what corporate governance means, since several definitions arise in the literature.

The origin of "corporate governance" comes from the ancient Latin and Greek. Clarke (2007, p.1) explains the etymology of the words as: "*The word corporate derives from the Latin word corpus meaning body, and comes from the Latin verb corporare to form into one body, hence a corporation represents a body of people, that is a group of people authorised to act as an individual. The word governance is from the Latinised Greek gubernatio meaning management or government, and this comes from the ancient Greek kybernao to steer, to drive, to guide, to act as a pilot. This etymological origin of the concept of corporate governance captures a creative meaning of collective endeavour that defies the contemporary inclination to place a passive and regulatory emphasis on the phrase*".

However, there is no specific widely accepted definition for corporate governance. Most of the existing definitions in the literature tackle the issue from different perspectives (Gillan 2006). Hodges et al. (1996, p.7) state that "*There is no single, authoritative definition of corporate governance', although there appears to be some agreement that it is concerned with the procedures associated with the decision-making, performance and control of organizations, with providing structures to give overall direction to the organization and to satisfy reasonable expectations of accountability to those outside it*".

Parts of these definitions take the narrow approach in which they discuss the relationship between a firm's managers and shareholders only. For example, Shleifer and Vishny (1997) state that corporate governance can be attributed to the ways that the owners of the firm can profit from investing their funds. Johnson et al. (2000) describe the governance of the firm by the use of successful tools that are able to reduce conflicts between owners and manager, especially the legal tools which offer protections for the owners' rights. According to the previous definitions, effective corporate governance under the stockholder approach views the management as

accountable to the owners by serving their interests and protecting their wealth (Cadbury 2000; Shleifer and Vishny 1997).

Other papers provide wider definitions of corporate governance to include different parties (Demb and Neubauer 1992; OECD 2004; Weimer and Pape 1999). These broader definitions fall under the stakeholder approach. For example, the OECD (2004) defines corporate governance as "*a set of relationships between company's management, its board, its shareholders, and other stakeholders. Corporate governance provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined*". John and Senbet (1998), in their definition of corporate governance, specify the firm's stakeholders and managers. For instance, 'stakeholders' refers to the supplier of funds, debt holders, consumers, employees, government and any other parties who deal with the corporation, while, 'managers', the entrepreneurs, refers to the agents who are responsible for investing these funds and take the main decisions of the corporation (John and Senbet 1998, p.2). Despite the disagreement on a single definition of corporate governance, most of these definitions have a common factor, which is accountability (Solomon and Solomon 2004).

Corporate governance tackles a problem that can be dated back to Smith (1776). The concept appears in the author's words when describing the role of the board of directors in public corporations: "*The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own*" (Smith 1776, p. 700). Mainly, corporate governance deals with conflicts that result from the separation of ownership from control. Simply, who manages the firm is not the owner, and, as a result, a conflict may arise between those two groups because they have different interests (Shleifer and Vishny 1997).

Berle and Means (1932) explain this conflict where large firms are managed by professional managers but owned by a large number of shareholders who own small equities. The dispersed ownership of the owners leads them to lose the incentive to monitor the behaviour of managers (Berle and Means 1932). As a result, the firm

will be viewed as being under the control of managers who prefer their own personal goals and benefits at the expense of those of the shareholders.

In the 1960s, several managerial theories appeared and tried to model managerial behaviour. These theories argue that the diffused ownership and weak monitoring reinforce the opportunistic managerial behaviour. Accordingly, managerial objectives may be favoured over those of the shareholders (Marris 1964; Monsen and Downs 1965). During the 70s and 80s, agency theory tried to find different mechanisms that aligned both managerial and shareholder interests. For example, Jensen and Meckling (1976) propose that providing managers with equity ownership motivates them to work in the best interests of shareholders. Likewise, Murphy (1985) recommends that the firm objectives should be linked to a proper compensation package that serves as an incentive to the firm managers and reduces the conflict of interest.

Fama (1980) and Fama and Jensen (1983b) suggest other mechanisms that may work to discipline managers. Among these mechanisms, the authors emphasise the role of the board of directors. The board of directors is considered to be the most important internal corporate governance tool (Fama and Jensen 1983b). An effective board should be able to mitigate agency conflicts through monitoring managerial action (Fama and Jensen 1985). Nowadays, the importance of board effectiveness has greatly increased and has become one of the corporate priorities for success.

The UK is considered a leader in corporate governance advancements and reforms. The principles of best practice in corporate governance follow a voluntary approach, i.e. listed firms should follow the recommendations of governance codes or justify otherwise. The Cadbury Report (1992) was the most influential and important report in the UK. This report serves as guidance to improve the governance of UK listed companies. In general, the Cadbury Report (1992) addresses the importance of the board of directors as the main governance tool: disclosure and transparency and the role of institutional investors. Following the issuance of the Cadbury Report (1992), the Financial Services Authority, which is responsible for corporate governance codes and recommendations in the UK, issued several series of revised reports and codes. The aim of these revised versions is continuous development in corporate

governance practices. These series include Greenbury (1995), Hampel (1998), Combined Code (1998), Turnbull (1999), Higgs (2003), Smith (2003), revised versions of the Combined code in 2003, 2006 and 2008, and recently the UK corporate governance code of 2010.

For example, the Greenbury Report was published in (1995) and mainly focused on directors' remuneration system. The Hampel Report was published in 1998; this report emphasised the aspects in the previous reports and gave more attention to the role of institutional investors in corporate governance. In 1998, the first combined code was published and the recommendations were directed to the listed companies and institutional investors. The combined code gave special attention to the internal control system in the firms. Following the combined code, the Turnbull Report was published in 1999. In addition to the aspects that were emphasised in the previous publications, the Turnbull Report was the first one to provide recommendations on risk management. For instance, the Turnbull Report states in the statement of internal control that:

"*the board should, as a minimum, disclose that there is an ongoing process for identifying, evaluating and managing the significant risks faced by the company, that it has been in place for the year under review and up to the date of the approval of the annual report and account*" (Turnbull 1999, p.11).

Another step in corporate governance reform in the UK has been witnessed by the publication of the Higgs report in 2003. The main focus of this report was on the role of non-executives directors on the board of directors in terms of their effectiveness and independence from management. In addition, the Higgs report emphasises the importance of gender diversity and criticises the male domination on the UK boards of directors. This report shows that, in 2002, females represented only 4% of executive directors, 6% of non-executive directors and less than 1% of chairpersons on the boards of UK listed companies.

In the same year, the Smith report was published; it mainly focused on the role of audit committee and external auditing in protecting and supporting the financial reporting system in the firm. In 2003, the revised combined code was introduced and

basically addresses most of the aspects in the previous reports. However, there was one noticeable change: the code required an increase in the proportion of non-executive directors on the board from a third to at least half of the board. The 2003 combined code was followed by several revised versions in 2006, 2008 and the latest one was in 2010; the latter is called the UK corporate governance code.

The recent UK corporate governance code supports gender diversity on the board of directors and calls for more female appointments in this regard. For instance, in section B.2 (p.13), the code states that: "*The search for board candidates should be conducted, and appointments made, on merit, against objective criteria and with due regard for the benefits of diversity on the board, including gender*".

Similarly, the UK corporate governance code 2010 gives more attention to the role of the board of directors, especially after the recent financial crisis in managing corporate risk taking. For example, the code states that: "*The board is responsible for determining the nature and extent of the significant risks it is willing to take in achieving its strategic objectives. The board should maintain sound risk management and internal control systems*" (UK Corporate Governance Code 2010, p.7).

Furthermore, to protect the firm's shareholders and ensure that a clear process is established in managing and controlling corporate risk taking, particularly after the massive losses incurred during the recent crisis, the recent code in section C.3 (P.19) states that:

"*The board should establish formal and transparent arrangements for considering how they should apply the corporate reporting and risk management and internal control principles and for maintaining an appropriate relationship with the company's auditor*".

1.2 Motivation of the Study

Corporate risk taking is one of the most important components in the managerial decision-making process that affects the success of a firm (Kim and Buchanan 2008). Despite this importance, it is ignored in most corporate governance studies. By reviewing the large body of corporate governance literature, it is clear that the board structure has extensively been studied with corporate performance (see for example, Boyd 1995; Coles et al. 2008; Eisenberg et al. 1998; Yermack 1996), while only a few studies take into consideration how the structure of the board is related to corporate risk taking. Ingley and van der Walt (2008, p.45) describe studying the board of directors in relation to corporate risk taking "*as a new area of enquiry in corporate governance research*". Faleye and Krishnan (2010, p.8) argue that "*internal bank governance features such as board characteristics have been largely ignored when analysing the association between bank governance and risk*".

Most prior corporate governance studies have focused on corporate performance and little has been done regarding corporate risk taking. Even the few papers that examine the relationship between board structure and corporate risk have either focused on non-financial firms (Adams et al. 2005; Brick and Chidambaran 2008; Cheng 2008; Nakano and Nguyen 2012; Wang 2012) or studied banks only and ignored the rest of the financial sector (Erkens et al. 2012; Minton et al. 2014; Pathan 2009). Unfortunately, financial institutions have been excluded from most corporate governance studies (Erkens et al. 2012).

However, it can be argued that corporate governance seems to be more important in the financial sector. The importance stems from the fact that financial institutions provide access to the payment system, generating liquidity, and playing an important risk management role in the economy (Andres and Vallelado 2008; Arun and Turner 2004; Levine 2004; Staikouras et al. 2007). Further, the complexity and importance of the financial sector affects the stability of the whole economy and the welfare of most individuals (Andres and Vallelado 2008; Arun and Turner 2004). Gordon and Muller (2011) explain the "*contagion mechanism*", in which the failure of one financial institution leads to the failure of others in the sector. This is because the

credit and financial relationship between financial institutions allows the so-called *cascading effect*.

Further, the financial sector has unique characteristics in which corporate governance mechanisms may work differently (Andres and Vallelado 2008; Prowse 1997). For example, financial institutions operate in a higher risky environment with very complex products and instruments (Andres and Vallelado 2008), have more opaqueness and greater information asymmetry (Adams and Mehran 2003; Macey and O'Hara 2003; Prowse 1997), have a more acute level of agency problem (Aebi et al. 2011; Andres and Vallelado 2008) and are more heavily regulated (Levine 2004). Accordingly, Adams and Mehran (2003) and Macey and O'Hara (2003) argue that these special features in the financial sector should be considered in corporate governance studies.

Furthermore, the majority of the prior empirical papers were conducted in the US, and it is difficult to generalise the findings of these papers to other countries such as the UK. The differences in regulations, financial reporting & disclosure, and governance practices justify the need for more investigation using independent data from the UK (Aguilera and Cuervo-Cazurra 2009; Filatotchev and Boyd 2009).

Although the board of directors in both the UK and the US share similar duties and responsibilities, several differences exist that are worth mentioning. In the US, the board of directors is dominated by non-executive directors while in the UK the board is dominated by executive directors (Short and Keasey 1999). However, it is important to note that the UK Financial Services Authority, which is responsible for the corporate governance practices, had issued a series of corporate governance codes that recommends increasing the number of non-executive directors in order to enhance board effectiveness (Solomon and Solomon 2004). For example, the old version of the combined code of 1998 required that one-third of the board should be non-executive directors, whereas, in the revised version of the corporate governance code in 2010, the percentage was increased: half of the board should be non-executives.

The monitoring function of non-executive directors may be weaker on the UK boards than the US ones. According to Guest (2008), the role of non-executives in the UK is an advisory one. This implies that very few non-executives in the UK face legal accountability in the case of not fulfilling their responsibility towards shareholders (Black et al. 2005; Franks et al. 2001). In addition, the compensation structure in terms of shares or payment is lower in the UK than in the US, which may reduce non-executives' effectiveness to perform their duties (Cosh and Hughes 1987). Although the US board is dominated by non-executive directors, it suffers by having a powerful CEO (Guest 2008). This is because most of the US firms combine the positions of CEO and chairperson together, i.e. CEO/Chairperson duality, while 90% of the UK firms have a separate title for the CEO and chairperson (Higgs 2003).

Short and Keasey (1999) and Guest (2008) among others indicate that both countries have an active market for corporate control but it is stronger in the UK. Moreover, the concentration of institutional ownership in the US is lower than in the UK. Institutional investors in the UK are mainly pension funds and insurance companies and play a more active role in the monitoring on the board, while in the US, institutional investors mainly are mutual funds that face legal restrictions, which results in a lower monitoring role on the board (Short et al. 1999). Unlike the US, the UK adopts a voluntary approach for corporate governance practices where the UK firms either follow the code provisions or provide justification for why they have not done so (UK Corporate Governance Code 2010).

Taken together, it is obvious that several differences exist between the UK and US. These differences are mainly related to the board structure, ownership structure, and market for corporate control, as well as other accounting and legal regulations. Therefore, it is important to use country-specific data to examine the effect of board structure on corporate risk taking. As indicated above, since most of the previous papers rely on US data, this study employs a panel dataset from the UK listed firms and covers both financial and non-financial sectors.

This study is also motivated in investigating the impact of female directors on corporate risk taking. This relationship is weakly addressed in the literature since the

focus of prior papers was on gender diversity and corporate performance (Adams and Ferreira 2009; Campbell and Mínguez-Vera 2008; Carter et al. 2008). The literature indicates that the presence of female directors on the board of directors adds value through their unique, diverse human capital (Carter et al. 2010). Boards with more gender diversity are expected to be more activist and to make better decisions (Adams and Ferreira 2009). However, with respect to risk taking, very few papers examine the relationship between females in the boardroom and corporate risk taking, which represents a clear gap in the literature.

Further, several studies in sociology and psychology have inspected the gender differences in risk-taking behaviour and show that, in general, females are more risk averse (Holt and Laury 2002; Jianakoplos and Bernasek 1998). These studies use laboratory and gambling experiments and focus on the sociological and psychological aspects (Eckel and Grossman 2008; Fehr-Duda et al. 2006). Moreover, the samples of these studies include females from the general population (Adams and Funk 2012). Providing evidence that females in high leadership positions are different from those in the general population may have several important implications. One of these implications is that the discrimination towards female appointments to leadership positions may be reduced. This is because female directors may be stereotyped as less qualified and more risk averse, which may lead firm mangers to be reluctant to offer high leadership positions to them (Adams and Funk 2012).

1.3 Objectives of the Study

The importance of studying the structure of the board of directors stems from its effect on how the board effectively performs and works (Cochran et al. 1985; Kesner 1987). In this study, board structure refers to the board size, independence and CEO/ Chairperson duality since these variables are the most important and most debated in corporate governance studies (Adams et al. 2010; Hermalin and Weisbach 2003; Wintoki et al. 2012). However, the literature indicates that other aspects such as board process and directors characteristics (directors' pay, directors' tenure and directors' skills) affect decision-making and the corporate risk-taking behaviour. Board process captures how the decision-making process is influenced

by the behaviour and the interaction between executives and non-executives on the board (Forbes and Milliken 1999; Pettigrew and McNulty 1995; Wan and Ong 2005; Zahra and Pearce 1989). According to Forbes and Milliken (1999), "effort norms," "cognitive conflict," and "the use of knowledge and skills" are an important variables that indicate how the directors on the board participate and involve in the board meetings, the disagreement among directors, the use of information from different perspectives and to which extent the knowledge and skills are used in the decision-making process. A recent empirical evidence from the UK provides support to the relevance of board process to the corporate risk taking (McNulty et al. 2013). Although board process is an important aspect, it is not within the scope of this study.

Directors' characteristics are also expected to be associated with corporate risk taking. For instance, directors with long-term tenure have more knowledge and expertise and more able to improve decisions' quality (Payne et al. 2009; Vafeas 2003). The directors skills and knowledge may also affect the corporate risk taking since these abilities may help in better evaluation for investment opportunities (Minton et al. 2014). Similarly, the compensation package may alter the managerial risk taking preferences. The theoretical arguments provided by Jensen and Meckling (1976) and Haugen and Senbet (1981) indicate how the financing choice and investment decisions may be influenced by the managerial stock and stock option holdings.

Risk committees may also play important roles in the decision-making process and particularly in those decisions related to corporate risk. The existence of such committees may provide several advantages. Board committees meet more frequently and independently from the full board (Klein 2002) . In addition, these committees have a specific, clear and limited function to perform (Jiraporn et al. 2009; Kesner 1988). These characteristics make them attractive to be initiated especially in large corporations where board members have to carry out a huge amount of activities (Harrison 1987). Kesner (1988) argues that most of the critical decisions are taken by the sub-committees not the full board.

This study focuses on three structural variables i.e., board size, board independence and CEO/chairperson duality. The selection of these variables is motivated by the mixed and inconclusive results on how these variables are related to corporate outcomes. Adams et al. (2010) argue that the endogenous nature of board structure variables lead to several problem in the estimation method and this make it difficult to view the actual effect of governance practice. In addition, Wintoki et al. (2012) argue that board size and independence are the main variables that are endogenously determined. Likewise, Hermalin and Weisbach (2003, p.15) state that "*we tend to see independence as the true causal variable, with size and board composition as correlates*".

For example, several papers document that the board size affects the decision-making process in the firm. Yermack (1996) and Eisenberg et al. (1998) argue that smaller boards are more effective and lead to higher corporate value. The authors explain that smaller boards have fewer communication and coordination problems and thus are more effective in taking decisions. However, Coles et al. (2008) indicate that larger boards are better able to enhance the value in larger, more diversified and levered firms as complex firms require more directors to carry out the work (Linck et al. 2008). The literature indicates that the effect of board size on corporate outcomes is still mixed and inconclusive (Cheng 2008; Nakano and Nguyen 2012).

Mace (1971) indicates that the existence of the correct mix of directors in terms of executives and non-executives[1] determines the board's ability to perform its service role. Likewise, Baysinger and Hoskisson (1990) note that the type of directors on the board affects the implementation of the firm strategy. The non-executive directors are considered to be objective, experts and to care for their own reputation in the labour market (Eisenhardt 1989; Jensen and Meckling 1976; Kesner 1987). More importantly, the non-executive directors are usually considered independent from the firm management (Hart 1995) and are expected to work in line with shareholder interests and effectively monitor managerial actions (Lim et al. 2007). However, since the independence from management is unobservable this leads to

[1] In this study, the terms independent directors, outside directors and non-executive directors are used interchangeably.

question whether those directors are truly independent or not. The unobservability of directors' independence also leads to mixed and inconclusive results regarding their effect on corporate outcomes (Adams et al. 2010; Hermalin and Weisbach 1991, 1998, 2003).

Another important aspect of board structure that affects board effectiveness is the CEO/ Chairperson duality. According to agency theory, combining the positions of the board chair and CEO may negatively affect the corporate value (Jensen 1993). The reason behind that refers to the power being concentrated in the CEO's hands, which may result in a less effective board (Kim and Buchanan 2008). A powerful CEO may dominate the board and this situation may end with less effective monitoring from the other directors on the board as well (Jensen 1993). The empirical evidence is also mixed and inconclusive on how combining or separating these roles may affect corporate value. Further, the dynamics of the board of directors and the endogenous nature of its structure complicates studying the board structure's effects on corporate outcomes and reaching consistent findings. In addition to these three structural variables, this study controls for the CEO ownership, existence of risk committee on the board of directors and a set of firm financial characteristics.

Recently, the media, regulators and social agencies have called for the increase of female representation on corporate boards (Baixauli-Soler et al. 2014). Most of these calls support the equal opportunities that should allow females to join corporate boards (Campbell and Minguez-Vera 2010). Prior literature documents that the effectiveness of the board of directors is enhanced with greater gender diversity (Carter et al. 2003). The presence of female directors on the board offers heterogeneous views and perspectives that lead to a better decision-making process. With respect to risk, gender differences in risk-taking behaviour and the widespread belief that females are more risk averse are well documented in the literature (Croson and Gneezy 2009). While this belief may be true for females in the general population, the story may differ for females in high leadership positions (Adams and Funk 2012). In this regard, the empirical evidence is limited and the results are inconclusive.

Based on the above discussion, this study has the following objectives. First, to investigate the impact of board structure on corporate risk taking in the UK public firms. More specifically, the study examines the effect of board size, board independence, and CEO/Chairperson duality on idiosyncratic risk. As indicated above, the limited numbers of studies that address the board-risk relationship in addition to the mixed and inconclusive results shape the base for this study to provide empirical evidence on this relationship using a dataset from the UK market. Further, this study aims to investigate this effect in two different sectors, i.e. the financial and the non-financial sectors.

Second, this study aims to investigate the effect of female directors on corporate risk taking in the UK financial and non-financial firms. Further, it aims to identify whether having female directors on UK boards determines corporate risk taking and, based on the idea that gender diversity enhances board effectiveness, to also test if the presence of female directors on the board has a concave effect on corporate risk taking.

Third, this study aims to provide evidence from the recent financial crisis by investigating the relationship between board structure, female participation on the board and corporate risk taking during this crisis. To do so, this study creates three sub-samples: pre-crisis, crisis and post-crisis periods, to highlight the effect of board structure and female directors on corporate risk taking in these three periods for the financial and non-financial firms.

In order to meet these objectives, this study will try to answer the following research questions:

1. Is there a relationship between board structure and the corporate risk-taking behaviour in UK firms?
2. Is there a relationship between inclusion of female directors on the board and the corporate risk-taking behaviour in UK firms?
3. Are the board structure and the presence of female directors related to the corporate risk-taking behaviour of UK firms during the recent financial crisis?

To answer these questions, this study developed a set of hypotheses between the interested variables. Table 1.1 provides a summary of these hypotheses that were developed in the three empirical chapters in this study.

1.4 Contributions of the Study

This study is one of a very few studies that have examined the effect of board structure on corporate risk taking. By recognising this gap in the literature, this study aims to fill it and open a new line of research that could enhance our understanding of this relationship empirically. Therefore, this study contributes to the corporate governance literature by assessing the relationship between board structure in terms of board size, independence and CEO/Chairperson duality and corporate risk taking in the UK.

As indicated in the above discussion, financial institutions are excluded from most of corporate governance studies. This study, therefore, contributes to the corporate governance literature by investigating the effect of board structure on corporate risk taking in the regulated industries. More importantly, this study is considered to be the first in the UK that investigates if board structure variables are determinants of corporate risk taking in the financial sector. The sample of this study is constructed from banks, insurance companies, financial service and real estate firms. Furthermore, the sample covers all the UK financial institutions that are listed in the FTSE All-Share Index. Including the financial sector is an important contribution of this study. The importance of this sector and the limited number of studies that examine governance mechanisms in the financial sector serve as a motivation to conduct this study. Moreover, the recent financial crisis, which originated in the financial sector, also sheds light on these institutions and calls for more analysis.

Further, this study contributes to the literature on gender differences in risk-taking by exploring the effect of female directors on risk taking in the business workplace; more specifically, the females' presence inside the boardroom. Understanding whether corporate risk taking can be expected to differ if more female directors join the board is particularly important in light of the recent pressure to increase the female representation on the board of directors (Martín-Ugedo and Minguez-Vera

2014). For example, in the UK, the 2010 corporate governance code states in section B.2, that "*The search for board candidates should be conducted, and appointments made, on merit, against objective criteria and with due regard for the benefits of diversity on the board, including gender*". Thus, this study contributes to the corporate governance literature by investigating the effect of group composition on the corporate strategic outcomes. The findings of this study might explain the increased calls for boards with more female directors.

In addition, this study contributes to the corporate governance literature by providing evidence on how the board structure and the presence of female directors are related to the corporate risk taking during the recent financial crisis 2007-2009. The study examines this relationship for both the financial and non-financial sectors in three sub-periods. These periods are: pre-crisis period (2004-2006), crisis period (2007-2009) and post-crisis period (2010-2012).

In terms of methodology, this study follows Wintoki et al. (2012) and employs a dynamic panel estimator system GMM in the data analysis. The choice of this estimation method is to mitigate the endogeneity problem. The corporate governance literature indicates that the board structure is endogenously determined (Guest 2009; Hermalin and Weisbach 1988, 2003; Wintoki et al. 2012). Further, Wintoki et al. (2012) indicate that three types of endogeneity arise in studying the board structure relationships, namely unobserved heterogeneity, simultaneity and dynamic endogeneity. According to Wintoki et al. (2012), most prior corporate governance studies fail to control properly for the three types of endogeneity, particularly dynamic endogeneity. Therefore, the choice of the estimation method in corporate governance studies is extremely important and should be carefully selected in order to provide robust and consistent results.

The most common technique in the literature to control for endogeneity is using the instrumental variables method (Guest 2010; Wintoki et al. 2012). However, finding a strict exogenous instrument to be used is a very difficult task in corporate governance studies (Wintoki et al. 2012). Other traditional methods like OLS and fixed effect, which are usually used in corporate governance studies, provide biased and inconsistent results. For instance, while the fixed effect may be able to control

for the unobserved heterogeneity it fails to do so with dynamic endogeneity (Wintoki et al. 2012). According to Wintoki et al. (2012), the dynamic panel estimator system GMM is able to fully control for all types of endogeneity and provide consistent results.

1.5 Structure of the Thesis

This chapter has presented a brief overview on the background and rationale of this study. The study motivation, objectives and contributions are also highlighted in this chapter. ***Chapter 2*** provides the review of the theoretical and empirical work on the board structure and female directors' effect on corporate risk taking. The chapter begins with a detailed review of agency theory since it is the most popular and dominant theory in corporate governance studies. In addition, the review highlights the empirical papers on the board structure-risk taking relationship. The empirical papers that examine the effect of the board structure during the recent crisis are also included and reviewed. Further, the chapter moves to review the theoretical work on the importance of gender diversity on the board. The last part of Chapter 2 provides the theoretical and empirical papers on the relationship between female directors and corporate risk taking.

Chapter 3 presents the methodological frameworks that are employed in the current work. This chapter highlights the data collection process and the sample construction criteria. The chapter also explains the definition and measurement procedures of the main study variables, i.e. dependent, independent and control variables. Furthermore, the empirical models and the expected econometric problems that may arise in the data analysis are discussed. Moreover, it describes the main estimation method, system GMM, in detail and provides justification for the selection of this technique.

Chapter 4 presents the empirical evidence on the relationship between the board structure and corporate risk taking. In this chapter, first the hypotheses to be tested are developed. Several empirical tests are conducted to find the appropriate dynamic framework for the empirical models. These empirical tests confirm that the board structure variables in addition to the firm financial characteristics are endogenously

determined. Using two estimation methods, namely OLS and system GMM, this chapter reports the results of the relationship between board structure and corporate risk independently for the non-financial and financial sectors.

Chapter 5 provides the empirical findings on the relationship between female directors and corporate risk taking. The chapter begins with the hypotheses development. Further, the chapter moves to the empirical analysis where the main estimation method is system GMM. The empirical findings indicate that the effect of female directors on corporate risk in each sector is different. The justification and discussion of the results are also included.

Chapter 6 examines the impact of board structure and the presence of female directors on corporate risk during the recent financial crisis, 2007-2009. In this chapter, the period of study is divided into three sub-periods, i.e. pre-crisis, crisis and post-crisis periods. Further, the main analysis takes place in the three different periods in order to consider the crisis effect for both sectors. In this chapter, the main estimation is "GLS". Since the full period of the study was divided into three sub-periods, this limits the use of system GMM in this chapter as for this technique at least five years' consecutive data is required.

The final chapter, ***Chapter 7***, summarises the empirical findings of the study and concludes the whole work. In addition, it provides the possible implications of the study findings, contributions, and limitations as well as suggested recommendations for future research.

Table 1.1 List of Hypotheses Developed in the Empirical Chapters

Board Structure and Corporate Risk Taking
Hypothesis 1: There is a negative relationship between board size and corporate risk taking. ***Hypothesis 2***: There is a negative relationship between board independence and corporate risk taking. ***Hypothesis 3***: There is a negative relationship between CEO/Chairperson duality and corporate risk taking.
Female Participation on the Board of Directors and Corporate Risk Taking
Hypothesis 1a: The proportion of female directors on the board is a determinant of corporate risk taking. ***Hypothesis 1b***: There is a quadratic concave effect of the proportion of female directors on corporate risk taking.
Board Structure, Female Participation on the board and Corporate Risk Taking during the Recent Financial Crisis
Hypothesis 1a: There is a negative relationship between board size and corporate risk taking in the pre-crisis period. ***Hypothesis 1b***: There is a negative relationship between board size and corporate risk taking in the crisis period. ***Hypothesis 1c***: There is a negative relationship between board size and corporate risk taking in the post-crisis period. ***Hypothesis 2a***: There is a negative relationship between board independence and corporate risk taking in the pre-crisis period. ***Hypothesis 2b***: There is a negative relationship between board independence and corporate risk taking in the crisis period. ***Hypothesis 2c***: There is a negative relationship between board independence and corporate risk taking in the post-crisis period. ***Hypothesis 3a***: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the pre-crisis period. ***Hypothesis 3b***: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the crisis period. ***Hypothesis 3c***: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the post-crisis period. ***Hypothesis 4a***: The proportion of female directors on the board is a determinant of corporate risk taking in the pre-crisis period. ***Hypothesis 4b***: The proportion of female directors on the board is a determinant of corporate risk taking in the crisis period. ***Hypothesis 4c***: The proportion of female directors on the board is a determinant of corporate risk taking in the post-crisis period.

Chapter 2

Literature Review

2.1 Introduction

Corporate governance deals with the conflicts arising from the divergence of interests in the agency relationships (Shleifer and Vishny 1997). The roots of these conflicts can be attributed to the separation of ownership and control, diffuse ownership and inability to write complete contracts (Berle and Means 1932; Hart 1995). These conflicts also shape the base for developing effective corporate governance mechanisms. Keasey and Wright (1993) suggest that corporate governance needs to deal with two essential dimensions. The first one is monitoring the managerial actions and ensures their responsibility towards firms' shareholders. This part highlights the stewardship and accountability dimension of corporate governance. The second one is providing the management with appropriate incentives to align their interests with firms' shareholders. According to Keasey and Wright (1993), corporate governance involves several mechanisms that aim to minimise such conflicts and increase the wealth of the firm.

This chapter starts with a review of agency theory, which is the most popular theory in the literature that provides the theoretical background which explains the nature and the context of such conflicts in the agency relationship (Jensen and Meckling 1976; Ross 1973). Understanding agency theory is the first step in knowing how corporate governance mechanisms such as the board of directors may affect corporate outcomes. The chapter then moves to focus on the board of directors as the main internal governance tool. After providing the theoretical explanations for the role of the board, the empirical work on the board structure and corporate risk taking is also reviewed and discussed.

The last part of this chapter focuses on gender diversity on the board of directors. The literature indicates that the presence of females on the board of directors enhances the board's effectiveness (Kang et al. 2007) and increases board independence (Carter et al. 2010). Further, the theoretical background on the gender

differences in risk-taking behaviour is also provided. Moreover, the empirical papers that examine the link between the presence of female directors and corporate risk taking are also presented and reviewed.

The focus of this study is to indicate how the structure of the board of directors and the presence of female directors are related to corporate risk taking. Therefore, the aim of this chapter is to provide a review of the theoretical and empirical related work. This chapter is organised as follows: section 2.2 reviews the agency theory. Section 2.3 reviews the board of directors as the main internal governance mechanism and as a solution to the conflicts in the agency relationships. The review in this section also covers the empirical work on the relationship between board structure and corporate risk taking, considering the effect of the recent financial crisis as well. Section 2.4 starts with a review of gender diversity on corporate boards. Furthermore, this section reviews the theoretical and empirical work on the presence of female directors is related to corporate risk taking. The final section summarises and concludes the whole chapter.

2.2 Agency Theory

Agency theory was developed by Ross (1973) and Jensen and Meckling (1976). In particular, Jensen and Meckling (1976) formally provide a detailed theoretical explanation of agency theory. This theory mainly discusses the conflicts arising between the principals, i.e. the owners of the firm who provide the source of funds, and what is called the agents, i.e. the management (Jensen and Meckling 1976; Ross 1973). The main assumption of agency theory is the self-serving managerial behaviour (Eisenhardt 1989). This implies that firm managers are expected not to work in the best interests of shareholders (Jensen and Meckling 1976).

The roots of these conflicts stem from the separation of ownership and control, which was discussed in the seminal work of Berle and Means (1932). According to Berle and Means (1932), firms begin small in size and the full ownership is related to the establisher, who is usually called the entrepreneur. Up to this stage, there is still no conflict of interest: the entrepreneur owns and manages at the same time. Therefore, the entrepreneur has the motivation to provide the maximum efforts

because all the earnings will be for him/her. However, the case is different when the firm becomes larger and larger since more capital is needed to finance the operations.

Berle and Means (1932) indicated that the entrepreneur will seek external capital from the stock market. This mean the ownership of the firm is no longer related to the entrepreneur alone. Other parties who provide the funds share the ownership and look for a return from its operation as well. The entrepreneur's incentives to work hard are different now as part of the outcomes will go to the other owners. Berle and Means (1932) explained that, at the point where the entrepreneur sells his/her entire shares in the firm, the firm is directed by professional actors who usually own nothing or very few shares.

According to the view of Berle and Means (1932), the division of labour now is clear. The firm managers have the needed skills and knowledge to run the firm but they lack the capital for financing. In contrast, the owners have the capital but they lack the experience and knowledge to manage the firm. The separation of ownership and control takes place accordingly. As the firm continues to grow, there will be a large number of shareholders who own small equities in it. Therefore, the control of the firm will be in the hand of the managers, since those dispersed owners will not be motivated to monitor the managerial action (Berle and Means 1932).

Within the context of agency theory, Jensen and Meckling (1976, p.5) define the agency relationship as "*a contract under which one or more persons – the principal- engage another person – the agent- to perform some service on their behalf which involves delegating some decision making authority to the agent*". The basic assumption of agency theory is the divergence of interest between shareholders and managers (Eisenhardt 1989). Put differently, the agents may take decisions that serve their own interest. Shleifer and Vishny (1997, p.741) provide another definition for the agency problem: "*the difficulties faced by financiers in assuring that their funds are not expropriated or wasted on unattractive projects*".

The conflict of interest in the principal-agent relationship may be controlled if there is a complete contract (Fama and Jensen 1983b). In theory, a contract is described as

being complete if it determines accurately how the managers should behave under each circumstance (Fama and Jensen 1983b). In practice, it is impossible to write complete contracts due to the difficulties in predicting future events that affect most of the managers' decisions (Hart 1988; Williamson 1984). In addition, writing such contracts is complicated and difficult to formalise (Williamson 1984). As a result, both parties should agree on residual control rights, which means they should determine who is responsible for the decision-making process regarding issues that are not clear in the contract (Grossman and Hart 1986). Because firm shareholders lack the required qualification to take decisions, the firm managers end up with such control rights (Shleifer and Vishny 1997).

In such an environment in the firm, where managers end with control rights, managerial opportunism largely occurs through expropriation of shareholders' wealth (Grossman and Hart 1986). In turn, these managerial actions negatively affect the resources invested in the firm. The reason behind this is related to the divergence of interest between a firm's managers and shareholders. According to Denis (2001), the shareholders' interests are purely financial. However, the interest of firm managers is mainly related to employment concerns (Amihud and Lev 1981). Thus, agency theory assumes that mangers deviate from shareholder wealth maximisation and serve their own personal interests (Jensen and Meckling 1976).

One of the basic assumptions of agency theory is the shareholders' diffuse ownership (Fama and Jensen 1983b). Therefore, those shareholders are less motivated to monitor managers, who end up with the control right and engage in self-interested decisions (Jensen and Meckling 1976). However, the ownership concentration may be considered a tool that may control the principal agent relationship, according to agency theory; those investors with concentrated ownership are highly motivated to properly monitor the management (Shleifer and Vishny 1997). Nevertheless, the concentration of ownership may create another conflict, which is known as the principal-principal agency problem (PP) (Globerman et al. 2011; Wu et al. 2011; Young et al. 2008).

According to Young et al. (2008), the principal-principal conflict mainly occurs between the controlling and minority shareholders of the firm. Young et al. (2008)

argue that two conditions lead to this type of conflict, the existence of shareholders with concentrated ownership and weak corporate governance mechanisms as well as the legal system that cannot effectively protect minority shareholders' rights. In the presence of those two conditions, PP agency problems typically exist between the firms' majority and minority shareholders. In general, majority shareholders, or so-called large block holders, refers to the shareholders who own a substantial equity ownership in the firm (Shleifer and Vishny 1997).

Holderness (2003) explains that two reasons may encourage shareholders to concentrate their ownership in the firm: the shared benefits of control and the private benefits of control (Holderness 2003, p.54). Large block holders, particularly, seek to maximise their wealth and at the same time they have the ability to control the management to some extent (Shleifer and Vishny 1997). The literature indicates the benefits of large block holders since they are considered a source of power in the corporate governance literature. They serve as an effective monitoring tool for the managerial actions and decisions (Hoskisson et al. 2002; Kim and Buchanan 2008). The benefits in the previous paragraph are shared with the minority shareholders; this effect is known as shared benefits of control.

Despite the clear advantages of large block holders, their existence in the firm carries a cost as well. Large block holders may be motivated to expropriate the firm resources or have some special benefits that are not available to the minority shareholders (Holderness 2003). The main problem is that, while large investors use their voting power to serve their own benefit, this is not necessarily matched with other investors' interests in the firm, or that of employees or even the managers (Shleifer and Vishny 1997). Further, Shleifer and Vishny (1997, p.758) state that "*In the process of using his control rights to maximize his own welfare, the large investor can therefore redistribute wealth-in both efficient and inefficient ways-from others*". This statement can summarise the main conflict between large block holders and the minority shareholders.

Another type of conflict of interest also may arise between the firm's shareholders, who provide the source of equity financing, and the creditors, who provide the debt financing to the firm. The managerial decisions in some cases may lead to a

reduction in the value of the debtholders' claim, and at this point the conflict starts. Smith and Warner (1979) summarise the main reasons that create the conflict between bondholders and shareholders. First, dividend payout policy: in this case, the conflict arises from the additional increase in the amount of dividends that are paid to the shareholders. This action will lead to a reduction in the debt value. Second, the value of debt will be lower if the firm issues more debt either at the same or higher priority. Third, investing in high-risk projects also lowers the value of the debt; this is also known as "Asset substitution" (Smith and Jensen 2000).

Goergen (2012) provides a complete picture of such conflicts between the two parties. Shareholders have the tendency to gamble with the debtholders' fund by seeking high-risk investments. The reason behind this is, in the case of failure, the debtholders will bear most of the losses (Demsetz et al. 1997). On the other hand, the profit generated from the investment mainly goes to the firm's shareholders (Jensen and Meckling 1976). This is a common problem in the relationship between shareholders and debtholders of a firm. The debtholders have a limited upside from investing in the firm while the shareholders have the opposite case, unlimited upside with limited liability (Demsetz et al. 1997). Galai and Masulis (1976) and Jensen and Meckling (1976) argue that the firm's shareholders tend to prefer more excessive risk-taking behaviour. This tendency results from the moral hazard problem, the limited liability and the unlimited upside potential on their investments.

The corporate governance literature indicates some causes for the conflicts in the agency relationship such as differences in risk-taking preferences, free cash flow, moral hazard and information asymmetry. The next section highlights these sources of conflict.

2.2.1 Sources of Conflict in the Agency Relationship

The agency problem exists between managers and shareholders as a result of separation between ownership and control. Both shareholders and managers have different interests, and to fully understand why conflict arises it is important to understand the interests of each party. According to the finance theory, shareholders invest their capital in return for a yield on their investment (Sharpe 1963).

Therefore, shareholders are interested in wealth maximisation, which is in part reflected in the firm share price (Jin 2002). However, managers do their best to retain their jobs and not be replaced by shareholders. In addition, those managers have other interests related to their positions such as private benefits that are not available to the firm's shareholders (Denis 2001). These private benefits that the managers gain may be in the form of office expenses, meals and personal issues, etc. These benefits may be considered under the term of managerial consumption of perquisites (Denis 2001, p.193).

The literature highlights four sources that may create conflicts between firm managers and shareholders. These sources related to free cash flow, moral hazards, information asymmetry and differences in risk-taking preferences. ***Differences in risk-taking preferences*** may be considered as one source of conflict in the agency relationship**.** Managers and shareholders bear different levels of risk since each of them has a different interest. The main concern for the firm managers is related to the "*Employment Risk"* (Amihud and Lev 1981, p.606). According to Amihud and Lev (1981), the income that the managers receive from the firm is significantly important for them; and in most cases it represents the major part of their total wealth (Amihud and Lev 1981; Holmstrom and Costa 1986).

Further, the wealth of the managers mainly depends on the firm's performance, in particular bonus, stock option and profit-sharing system (Amihud and Lev 1981, p.606). Therefore, if the firm's managers fail to reach the predetermined level of performance, or in some cases achieve losses, accordingly the manager could lose his/her position and usually be replaced by the shareholders. This implies that firm managers invest all their human capital in the firm and this capital depends on the firm's success (Denis 2001).

The same point is also raised by Fama (1980, p.292), who states that "*the managers of a firm rent a substantial lump of wealth-their human capital-to the firm, and the rental rates for their human capital signaled by the managerial labor market are likely to depend on the success or failure of the firm*". According to this statement, the managerial human capital is concentrated in the firm and cannot be diversified. Another interesting point in Fama's (1980) argument is that the future employment

for the managers as well as their reputation in the market also depends on their firms' current performance, since the labour market evaluates the current performance of the firm they manage and this will determine their future employment chances. Hirshleifer and Thakor (1992) argue that managers tend to choose less risky investment since they are concerned only with their reputation in the market. This argument is consistent with the assumptions of agency theory. In the principal-agent relationship managers are considered to be risk averse, which may negatively affect the value of the firm (Fama and Jensen 1983b, 1983a; Jensen and Meckling 1976).

However, the shareholders are assumed to be risk neutral because of their ability to diversify their holdings. According to portfolio theory, the shareholders invest their funds in different firms, i.e. they diversify their investment. The losses that come from specific stock will not be an issue for them as their capital is well diversified (Fama 1980). The differences in the level of risk aversion clearly affect the investment and financing policy of the firm (Jensen 1986). Therefore, a conflict of interest arises between shareholders and managers, which in turn increases the agency cost (Fama 1980). The firm shareholders favour adopting risky projects that enhance their wealth (Jensen and Meckling 1976; Jensen and Murphy 1990). Based on this view, the firm's shareholders see all the positive net present value (NPV) as an attractive opportunity for investment (Denis 2001). However, this may not be consistent with the managerial interests, as they avoid value-enhancing projects to avoid failure and bankruptcy problems (Ferris et al. 1996).

Based on the diversification ability of both managers and shareholders, it is noticeable that managers are concerned with the firm's total risk, i.e. both systematic and non-systematic risk (Denis 2001). The shareholders, on the other hand, are only interested in systematic risk since they hold a well-diversified portfolio (Fama 1980). Therefore, managers will tend to follow diversification strategies in order to reduce failure risk and prefer to use more equity than debt (Jensen 1986). Similarly, Brennan (1995) argues that managers avoid using debt since debt increases the probability of default and bankruptcy.

Jensen and Meckling (1976) and Jensen and Murphy (1990), among others, argue that, in order to motivate managers to take more risky investments and therefore align their interests with the firm's shareholders, there should be suitable managerial incentives. Ferris et al. (1996) note that when there are no proper incentive structures managers will avoid risky investments. In addition, Ferris et al. (1996) indicate that such avoidance aims to reduce personal costs, like costs related to the managerial employment loss, the additional time and work required to deal with new investment, and inherent risk. Agency theory suggests different solutions that may bridge the gap between shareholders and managerial interest. For instance, providing managers with equity shares, stock option, etc. may motivate them to take more risk in their investment policy (Demsetz and Lehn 1985; Fama and Jensen 1983b; Jensen and Meckling 1976).

Free cash flow in the firm could be another source of conflict in the agency relationship. Jensen (1986, p.323) defined free cash flow as "*cash flow in excess of that required to fund all projects that have positive net present values when discounted at the relevant cost of capital*". The availability of such a source of funds creates conflict between shareholders and management. It is clear from the definition that all the positive NPV projects are financed and there are no more investment opportunities available. In this context, an important question arises here: how can the management deal with the free cash flow? The choices are limited: they can either pay it to the firm's shareholders, select investment projects even with negative NPV, or they may choose to waste it according to their preferences (Jensen 1986).

Given these alternatives and from the shareholders' point of view, they will not agree on the second and third choices. Investing in a project with negative NPV will affect the wealth of shareholders by reducing the share price in the market. Definitely, the third choice is not acceptable since the shareholders have the residual cash flow rights of the firm (Denis 2001). By all means, the shareholders' choice will be that these cash flows should be paid back to them in the form of dividends or stock repurchase (Jensen 1986). However, the management may prefer to keep the free cash flows instead of paying them back to the shareholders. Moreover, they might prefer to choose investments even with negative NPV. The idea here is that

even these bad projects lead to an increase in the firm size. Managers prefer increasing the assets under their control since growth in size provides them with more power, prestige, higher compensation and the ability to control the board of directors (Jensen 1986, 1993).

Another source of conflict is known as moral hazard, which refers to the possibility of the agent being less responsible and not exerting the maximum effort (Alchian and Demsetz 1972). Eisenhardt (1989, p. 61) defines ***moral hazards*** as *"lack of effort on the part of the agent"*. In other words, moral hazards exist because the principal cannot observe the managerial action all the time and, consequently, cannot judge the quality of the management team (Eisenhardt 1989). In the light of incomplete contracts and moral hazards, it is difficult for shareholders to control such conflicts in the principal-agent relationship. According to Denis (2001), the shareholders fail to conduct effective monitoring because they lack the proper experiences, which means that they may not understand the managerial actions. In addition, they lack incentives to perform this monitoring, especially when they own only a small equity in the firm and the monitoring cost may outweigh the benefit.

Agency theory assumes that the firm's managers, who run the daily affairs of the business, have more information than the shareholders (Fama and Jensen 1983b). This leads to ***information asymmetry,*** which is considered a source of conflict in the agency relationship. The existence of information asymmetry limits the shareholders' ability to properly monitor managerial actions and make sure that those managers are working in the shareholders' interest (Adams 1994). Further, the inability of shareholders to access all the information and therefore judge the managerial decisions creates so-called ***adverse selection***.

According to Eisenhardt (1989, p.61), "*Adverse selection refers to the misrepresentation of ability by the agent. The argument here is that the agent may claim to have certain skills or abilities when he or she is hired. Adverse selection arises because the principal cannot completely verify these skills or abilities either at the time of hiring or while the agent is working*".

The literature suggests several actions to mitigate the information asymmetry effect; for instance, the disclosure and financial reporting of private information, enforcing regulations which may obligate mangers to disclose certain information to shareholders, the existence of information intermediaries such as financial analysts who may reduce information asymmetry through facilitating disclosure between firm's managers and shareholders (Healy and Palepu 2001; Leftwich et al. 1981; Watts and Zimmerman 1983, 1986).

Corporate governance literature suggests several mechanisms that aim to minimise the effect of these conflicts in the agency relationship. However, Jensen and Meckling (1976) indicate that these mechanisms are not free and result in what is called the agency cost. The agency cost naturally results from the agency relationship in order to control the managerial opportunism. Further, the shareholders bear these costs to make sure their wealth maximisation is the managers' priority. According to Jensen and Meckling (1976), the agency cost is the sum of monitoring, bonding and residual loss cost. Monitoring cost refers to the actions and efforts that the principal takes in order to monitor the management behaviour. It is clear that this type of cost is paid by the principal to make sure that managers act in their interest. Monitoring action may include several activities such as incentives' policies and constraints on budget (Jensen and Meckling 1976). Shareholders may also bear the additional cost of using external auditing to check on the firm's financial statement and ensure that the moral hazards risk is minimised (Adams 1994).

The second part of the agency cost is related to bonding cost, which is incurred by the agent. The firm managers may want to exhibit to the principal that they are working as required (Jensen and Meckling 1976). These actions from the agent's side could serve as a proof of their accountability. The cost associated with these actions is not necessarily financial. For example, the managers may provide shareholders with additional information on the firm policy and structure (Jensen and Meckling 1976). Watts (1988) indicates that managerial expense on audit committees, non-executive directors and internal auditors are common examples of bonding cost.

The last component of agency cost is related to residual loss. Monitoring and bonding are incurred to align the interests of shareholders with those of managers. However, it is difficult to reach full alignment and still there will be a loss resulting from the divergence of interests between the two parties. Jensen and Meckling (1976, p.5) define residual loss as "*The dollar equivalent of the reduction in welfare experienced by the principal as a result of this divergence*". Fama and Jensen (1983a) add that, in the existence of incomplete contracts, the managerial decisions may not be in the best interest of the principals. Residual loss is incurred by the principal, and occurs when the full cost of contract execution exceeds the benefits (Fama and Jensen 1983a, p.327). Agency theory stresses the importance of corporate governance mechanisms that ensure the best alignment between managers and shareholders. Proper selection of such mechanisms will lead the managers to satisfy the shareholders' interests and therefore the agency cost will be minimised (Shankman 1999).

An extended version of agency theory is the multiple agency theory which deals with more complex relationships where there are multiple principals, agents or both (Arthurs et al. 2008). A common example of multiple agency conflicts appears when firms have partnerships with other firms through what is known as strategic alliances. These alliances usually shaped for specific purposes such as supporting foreign market entry or accessing certain technology or any different resources (Dussauge and Garrette 1999). Equity-based joint ventures are a common type of strategic alliance in which there is a pooling of ownership assets and this lead to a degree of joint management between two or more partner firms (Child and Rodrigues 2003).

In this regard, multiple principals where each has its own motivation for entering into the alliance and each is sufficiently salient to require its interests to be respected. In addition, since the owner-partners usually provide complementary assets to the joint venture (Geringer 1991), they also in effect become agents for each other in ensuring its viability. In the meantime, joint venture managers' are regarded as agents for its owners (Child and Rodrigues 2003). It is obvious therefore that multiple agency theory allows for many-to-many relationships with potential

conflicts among multiple principals and agents (Arthurs et al. 2008; Hoskisson et al. 2002).

Within the context of multiple agency theory, the potential conflicts in these complex relationships arise from divergence of interests among contractual parties. Arthurs et al. (2008) explain how the risk-taking behaviour for executive directors on the board is influenced by the investment time horizon and employment concerns. The study employs multiple agency theory to examine how different agents on the board of directors, in case of IPO process, with different interests are related to decision-making process. According to Arthurs et al. (2008), executive directors on an IPO firm's board of directors have longer-term investment horizon than venture capitalists and underwriters who usually are pressured to show quick returns. The dual identity of executive directors on an IPO firm's board of directors i.e., as principals and also as agents, lead them to be more effective monitors in the IPO process and more conservative in their investment decisions (Pratt and Foreman 2000). These arguments support the traditional agency theory assumptions on the executives' risk aversion behaviour due to the employment risk (Jensen and Meckling 1976).

Despite the importance of agency theory in explaining the nature of conflicts in the contractual relationship, other theories appear in the literature and tackle the issue from different perspectives. The next section briefly sheds lights on the main supporting theories of agency theory.

2.2.2 Supporting Theories of Agency Theory

Agency theory aims to select the suitable governance mechanisms that reduce the divergence of interest in the principal-agent relationship. This theory, in turn, dominates most of the corporate governance research (Daily et al. 2003; Eisenhardt 1989; Hill and Jones 1992; Zajac and Westphal 2004), even though, different theories arise in the literature which provide a complementary view to the agency problem. The most popular theories that support the notion of agency theory are: stakeholder theory, stewardship theory, and resource dependence theory. Daily et al. (2003, p.372) state that "*A multitheoretic approach to corporate governance is*

essential for recognizing the many mechanisms and structures that might reasonably enhance organizational functioning". These supporting theories provide a richer theoretical background and tackle the issue from different perspectives.

2.2.2.1 Stakeholder Theory

Stakeholder theory emerged gradually and was developed by Freeman (1984). The concept of stakeholders refers to several definitions in the literature. Stakeholders as a concept includes the firm shareholders, customers, suppliers, employees, creditors, communities and general public. In other words, it may include any individual or group that affects or is affected by the firm (Freeman 1984). In some extreme cases, even animals, the environment and the coming generation are also included in the definition (Solomon and Solomon 2004, p.24). Despite these broad definitions, other authors define stakeholders in terms of risk bearing with a firm (e.g.Clarkson 1995) or according to their relative importance to the firm as primary or secondary stockholders (Shankman 1999). However, it is noticeable that, whatever the definition, most of them share the so-called exchange relationship (Freeman 1984; Hill and Jones 1992; Pearce 1982; Shankman 1999).

The exchange relationship means that those stakeholders have an important effect on the firm as well as they are also affected by the firm's decisions. Hill and Jones (1992) mention a series of these exchange relationships; for example, the firm shareholders provide the required capital in exchange for a proper return on their funds. The creditors of the firm, who provide the financing, are looking for a full and timely repayment. Similarly, the management and employees, who provide the time, knowledge and required experience, are looking for a satisfactory income. Suppliers provide the material required in exchange for a reasonable price. Local communities also provide the firm with infrastructure and the place where the firm operates in exchange for a better lifestyle. Therefore, each stakeholder either implicitly or explicitly becomes part of the contractual relationship with the firm (Solomon and Solomon 2004).

The basic assumption of stakeholder theory is that, in order for the firm to survive and achieve its objectives, the management should be able to balance and satisfy the

interest of all its stakeholders (Hill and Jones 1992). By doing so, the company will be able to benefit from all the resources provided by its stakeholders (Shankman 1999). Stakeholder theory appears to be consistent with agency theory in some manner. The point here is that the firm will be able to maximise the shareholders' wealth while doing the same for the other stakeholders.

Hill and Jones (1992, p.132) argue that "*Like agency theory, this paradigm suggests that the firm can be seen as a nexus of contracts between resource holders*". Moreover, they clearly state that "*there is a parallel between the general class of stakeholder-agent relationships and the principal-agent relationships articulated by agency theory. Both stakeholder-agent and principal-agent relationships involve an implicit or explicit contract, the purpose of which is to try and reconcile divergent interests*"(p. 134).

2.2.2.2 Stewardship Theory

The basic assumption of stewardship theory is that the firms' managers are good stewards and work in the best interest of owners (Davis et al. 1997; Donaldson 1990; Donaldson and Davis 1991, 1994). Thus, mangers basically work to maximise the wealth of the owners , and, even if different stakeholders have different goals, the managers will make a decision that serves the firm's overall objectives (Davis et al. 1997). The roots of stewardship theory stem from organisational psychology and sociology. In this regard, the motive that direct the firm's managers to work is the tendency to achieve (Donaldson and Davis 1991). Agency theory focuses on the role of monitoring and how the agent should be controlled to serve the principal interest (Jensen and Meckling 1976). Stewardship theory, on the other hand, provides the manager with the power and independence required to serve the principal interest (Donaldson and Davis 1994).

Agency theory suggests that, in order to minimise conflicts in the principal-agent relationship and therefore minimise agency cost, the interests of both managers and principals should align (Jensen and Meckling 1976). This alignment, according to agency theory, could be achieved through providing mangers with an appropriate financial compensation structure to motivate them to serve shareholders' interests

(Eisenhardt 1989). Further, agency theory also proposes using a different governance structure such as the board of directors which is mainly responsible for monitoring the management (Fama and Jensen 1983a). However, stewardship theory assumes that the managerial behaviour is motivated by intrinsic rather than extrinsic incentives. Therefore, there is no need for the mechanisms that are suggested by agency theory to motivate managers (Davis et al. 1997; Donaldson and Davis 1991).

Agency theory, which basically assumes that the self-interested mangers will take decisions that serve their personal goals, stresses the existence of disciplining mechanisms. Therefore, the role of the board of directors is considered to be the main tool to control such behaviour. Agency theory suggests that the board should be dominated by independent directors (Hermalin and Weisbach 1991; Johnson et al. 1996). Independent directors are more effective monitors as they care about their reputation in the market (Fama 1980). In other words, independent directors are disciplined by the external market and are thus expected to serve the shareholders' interest (John and Senbet 1998). Therefore, based on agency theory assumptions, the board with more independent directors will enhance the firm's performance and protect shareholders' rights (Rosenstein and Wyatt 1990).

The literature provides various supporting evidence for the relation between independent directors and firm value. Dahya and McConnell (2007) examine the relationship between changes in board composition and corporate performance for 1124 UK industrial firms over the period 1989 to 1996. The study reports a positive relationship and indicates that UK firms that move towards three outside directors according to the Cadbury committee recommendations show an improvement in operating performance both in absolute terms and relative to various peer group benchmarks. Daily and Dalton (1992) and El Mehdi (2007) report a similar positive relationship.

Agency theory also suggests that the role of the CEO and the chairperson should be separated. When the two positions are combined, much more power will be concentrated in the CEO's hands (Donaldson and Davis 1991). In this case, the CEO will dominate the board and possibly this will increase his/her opportunistic behaviour. In the UK, the Cadbury Report (1992) recommends that these two

positions should be separated. The board leadership importantly affects the board's control function. Vafeas and Theodorou (1998) indicate that when the two positions are held by different persons the board effectively exercises its control function and therefore this will improve firm performance.

Stewardship theory provides a different view for the structure of the board of directors. The main assumption of the theory is that managers are trustworthy and in all cases their decisions will be in the interests of their principals (Donaldson and Davis 1994). Stewardship theory relies more on the role of inside directors and the dual role of the CEO. It assumes that the shareholders' interests will be better served if insider managers dominate the board of directors. This theory assumes that inside directors have more knowledge and experience than outside directors (Donaldson and Davis 1994).

Inside directors spend more time in running the firm's daily operation and accordingly they are more able to take the important decisions (Baysinger and Hoskisson 1990; Kesner 1987). Further, stewardship theory recommends that the role of CEO and chairperson should be combined (Donaldson and Davis 1994). By providing more power, the CEO who also holds the chair position will be more motivated to enhance firm performance. Donaldson and Davis (1991, p.52) argue that:

"*the expectations about corporate leadership will be clearer and more consistent both for subordinate managers and for other members of the corporate board. The organisation will enjoy the classic benefits of unity of direction and of strong command and control*".

Empirical results show support for stewardship theory in the literature. For example, Boyd (1995) analyses the relationship between CEO duality and firm performance in a sample of 192 US firms within 12 industries. The author concludes that firms that combine the two positions have better performance. Similarly, Haniffa and Hudaib (2006) report a significant positive relationship between duality and firm's accounting-based performance. However, agency theory is based on stronger

theoretical background and gains more empirical support in the governance literature.

2.2.2.3 Resource Dependence Theory

Resource dependence theory views the firm as an open system (Preffer and Salancik 1978). The basic assumption according to this theory could be summarised by Preffer and Salancik (1978), who state that "*to understand the behavior of an organization you must understand the context of that behavior—that is, the ecology of the organization*". Therefore, it deals with how the environmental elements may affect the firm and how firms may work within the context of this environment (Pfeffer 1972). This theory indicates that the firm should be able to adapt to external interdependencies in order to survive (Hillman et al. 2009). In this regard, the board of directors may play the major role in reducing uncertainty and dependence (Hillman et al. 2009, p.1404).

Resource dependence theory explains how the board of directors, which is considered to be an important corporate governance mechanism, serves as a key for external resources (Pfeffer 1972). For example, the independent directors, i.e. non-executives, who serve on the board are viewed as a valuable resource (Haniffa and Hudaib 2006). Non-executives directors have the ability to provide the firm with the necessary information through their organisational networks and match it with the firm's need (Nicholson and Kiel 2007). The board of directors is an important channel to the external resources that may enhance the firm's value. Preffer and Salancik (1978) mention four advantages the directors may provide: information through advice and counsel, links to the important information in the firm environment, gain of external resources through their networks and interlocks, and, finally, legitimacy.

Empirical support for the resource dependence theory arguments indicates the effect of directors. For example, Provan et al. (1980) show that firms that employ influential directors can gain more important resources from the external environment. Preffer and Salancik (1978) find that the need for non-executive directors who have the skills and experiences appears to be higher in the regulated

industries. More recently, Peng (2004) provided evidence that boards with outside directors who are able to gain resources have better firm performance. Similarly, Nicholson and Kiel (2007) indicate that directors with rich resources positively affect firm performance.

To summarise, resource dependence theory provides a different perspective than agency theory on the role of the board. While agency theory focuses on the monitoring and controlling role of the board, resource dependence theory views the board as a channel to resources in the external environment. Daily et al. (2003, p.275) argue that:

"*rather than focusing predominantly on directors' willingness or ability to control executives, in future research scholars may yield more productive results by focusing on the assistance directors provide in bringing valued resources to the firm and in serving as a source of advice and counsel for CEOs*".

Agency theory is the most popular theory that provides the theoretical background, explains the nature and the context of conflicts in the agency relationship (Jensen and Meckling 1976; Ross 1973). Moreover, agency theory receives much attention from researchers in the corporate governance area, and in turn, dominates most of the corporate governance research (Daily et al. 2003; Eisenhardt 1989; Hill and Jones 1992; Zajac and Westphal 2004). Further, agency theory offers a powerful tool for providing an insight into suggested solutions to the conflicts arising in the principal-agent relationship. Accordingly, this theory is taken as the main theoretical approach in studying the board structure-risk-taking relationship.

2.2.3 Agency Conflicts in the Financial Sector

In the previous sections, the discussions indicate that one of the agency theory assumptions is that managers are risk averse and shareholders are risk neutral (Jensen and Meckling 1976). However, the case in the financial sector may be viewed in a different way. In the aftermath of the recent financial crisis (2007-2009), the managers in the financial sector were accused of taking excessive risk (Kirkpatrick 2009). This excessive risk-taking behaviour was cited as being among

the main causes of the recent crisis (Kirkpatrick 2009; Magnan and Markarian 2011; Minton et al. 2014; Pathan 2009) .

In the financial sector, both the shareholders and managers have a higher tendency to take more risk (Sepe 2012). The reasons behind this behaviour are provided in the following discussions. As mentioned above, shareholders and debtholders have different risk preferences. Debtholders own a fixed claim in the company and have priority of payment over shareholders. Accordingly, debtholders are less interested in the increase of asset value, as their payoff is considered concave (Smith and Warner 1979). Further, debtholders are highly affected by the decrease in the asset value of the company. Therefore, debtholders favour less risky investments that preserve the asset value of the company (Smith and Warner 1979).

Shareholders, on the other hand, are highly affected by the increase in asset value of the company, as their payoff is considered convex. The shareholders are less interested in the decrease of the asset value, because they are protected by limited liability (Smith and Warner 1979). According to the different payoff structures, shareholders have the tendency and incentives to take on more risk (Smith and Jensen 2000). The asset substitution effect highly occurs in this case where the shareholders substitute low-risk investments with high-risk ones to capture all the possible upside potential, as discussed in the previous section. In other words, shareholders are transferring the wealth from the firm's debtholders (Smith and Jensen 2000). In the financial sector, the shareholders have more incentives for excessive risk taking than in the non-financial sector. According to Sepe (2012), the reason for this is: "*Shareholders' incentives for asset substitution increase with the debt-to equity ratio: the higher this ratio, the greater the measure to which losses are borne by debtholders rather than shareholders*". Accordingly, in highly leveraged firms there is an increased tendency for excessive risk taking.

Agency theory assumes that managers are more risk averse as they are unable to diversify like shareholders (Jensen and Meckling 1976). Many scholars describe the conservative investment choices of corporate managers as being due to the employment risk (Amihud and Lev 1981). To protect their positions and their human capital they may behave in a self-opportunistic way and serve their personal

interests at the expense of those of the shareholders (Baysinger and Hoskisson 1990). However, to mitigate these conflicts, one solution is to provide incentives to the corporate managers which align their interests with those of the shareholders (Jensen and Murphy 1990).

One of the recommended solutions is to provide managers with compensations that are tied to corporate value. Stock, stock options, and performance-based bonuses are the most common examples. Providing mangers with such incentives will make them more interested in increasing the asset value of the firm (Jensen and Meckling 1976). For example, the values of stock options increase with corporate risk taking i.e., increase with stock return volatility. Therefore, providing firms' executives with stock options that have convex payoffs will motivate them to undertake actions that increase firm risk (Bloom and Milkovich 1998; Rajgopal and Shevlin 2002). Guay (1999) and Rajgopal and Shevlin (2002) report positive effect of providing executives with stock options and greater investment opportunities.

McNulty et al. (2013) differentiate between executive and non-executive pay in the UK firms, and argue that since non-executives are not allowed to hold stock options they are less motivated to take more risk. Paragraph B.1.7 in Higgs Report (2003) state that: "*Levels of remuneration for non-executive directors should reflect the time and responsibilities of the role. Remuneration for non-executive directors in share options should be avoided*". Accordingly, it is expected that level of risk aversion will be different between executives, non-executives and shareholders as well. Non-executives are expected to be more risk averse than executive directors due to their flatter remuneration structure (McNulty et al. 2013). Unlike executives and non-executives, shareholders have higher tendency toward more risk taking since they are assumed to hold a well-diversified portfolio and protected by limited liabilities (Smith and Warner 1979).

In the financial sector, the high remuneration and incentives provided to the mangers contributed to the recent crisis (Kirkpatrick 2009). These high incentives, especially stock options and bounces, motivated managers in the financial institutions to take on more risk. In addition, the focus of those mangers was on the short-term profit rather than the long-term one (Kirkpatrick 2009). Many observers note that the

executives in the financial sector received massive incentives compared to those in the non-financial sector. For example, in 2000, on average the stock options for the CEOs of 27 large US banks was around $11.9 million while in the non-financial sector the figure was only $4.5 million for the CEOs. Further, in the financial sector the managers normally received high bounces reaching millions of dollars. For instance, in 2009, one manager at Citigroup received around $100 million as a bonus (Sepe 2012). Consistent with these arguments, a recent report from the OECD indicates that the remuneration system was not tied to the strategy and the long-term value in the financial institutions (Kirkpatrick 2009). Sepe (2012, p.346) describes the executive behaviour in the financial sector as follows:

"*Contrary to the conventional representation of managers as risk-averse agents, the banking sector's reliance on highly leveraged compensation schemes led managers to undertake increasingly outsized bets—tail risk in the jargon of finance. When the market turned sour, these reckless bets led to massive losses"*.

According to the previous discussion, it is noticeable that the executives' risk behaviour in the financial sector differs to some extent from that of those in the non-financial sector. The literature also indicates that the financial sector has special features. These special features have led many scholars to exclude the financial sector from most of the corporate governance studies. Macey and O'Hara (2003), Staikouras et al. (2007) and Andres and Vallelado (2008) among others agree that corporate governance analysis may differ in the financial sector due to many special features related to this industry. However, Andres and Vallelado (2008, p.2571) explain this by saying that:

"*the problem of bank governance does not differ greatly from the governance problem of any organization whose business involves an exchange of goods ……. such difficulties interfere with the way in which the usual corporate governance mechanisms are applied to the governance of financial institutions*".

The special features of the financial sector, which may require different governance practices, can be summarised in the following points. First, the agency problem in the financial sector is at a more acute level (Andres and Vallelado 2008; Arun and

Turner 2004). Caprio and Levine (2002) indicate that financial institutions are more opaque than non-financial firms. In this regard, greater information asymmetries in the financial sector lead to a serious agency problem (Nam 2004). For instance, the opaqueness around the quality of a bank's loan portfolio makes it not observable and managers can manipulate and quickly change the risk structure of their assets (Arun and Turner 2004; Becht et al. 2011). Moreover, large informational asymmetries mainly affect small investors who lack the experience to monitor managers. Morgan (2002) and Grove et al. (2011) among others argue that banks are very complicated and therefore there are greater information asymmetries, which in turn exaggerate the agency problem.

Second, financial institutions are more heavily regulated (Arun and Turner 2004; Macey and O'Hara 2003). As mentioned above, the economic importance of banks in any economy justifies the heavy regulation on these firms. In general, government intervention could be attributed to protect investors and financial sector stability (Staikouras et al. 2007). Andres and Vallelado (2008) indicate that the government role in the financial sector may serve as safeguarding investors' right and minimising systemic risk. However, on one hand, this intervention may be considered as a governance mechanism that reduces the agency problem. On the other hand, it may reduce the efficiency of other governance mechanisms and distort the bank's management behaviour (Andres and Vallelado 2008; Caprio and Levine 2002; Levine 2004). For instance, in most countries governments offer deposit insurance or what is known as "guarantee programme" or "safety nets" (Nam 2004). Thus, the existence of deposit insurance may cause moral hazard, in which investors become less motivated to monitor managers and instead rely on government guarantees. In the meantime, these safety nets encourage managers to take more risky decisions (Staikouras et al. 2007).

Third, in the financial sector, the competition is less intense than in other business sectors (Andres and Vallelado 2008; Arun and Turner 2004). Shleifer and Vishny (1997, p.738) state that "*product market competition is probably the most powerful force toward economic efficiency in the world, we are skeptical that it alone can solve the problem of corporate governance*". The basic argument here that is competition in the product market may serve as a substitute for the mechanisms of

corporate governance. The weak competition in the financial sector may be related to the heavy government regulations (Levine 2004). For example, the government limits the concentrated ownership and regulates the identity of bank owners in order to keep this industry stable, which in turn reduces competition. Furthermore, Prowse (1995) noticed that hostile takeover rarely occurs in financial institutions, which may also be attributed to the intensive government regulation. In practice, these regulations make takeover activities more expensive and time consuming. Due to the lack of these competitive pressures the managers of financial institutions require special governance mechanisms that are able to discipline them properly (Arun and Turner 2004).

The above discussion indicates that the special features of financial institutions make the external governance mechanisms, i.e. competition and hostile takeover, extremely weak. Therefore, internal governance mechanisms play an important role in the financial sector, especially with regard to the board of directors (Andres and Vallelado 2008; Nam 2004; Staikouras et al. 2007). Moreover, Andres and Vallelado (2008) and Staikouras et al. (2007) argue that the board of directors is considered to be the main governance mechanism that works to reduce the agency problem. In addition, the board can effectively monitor the managers as well as the bank's policies and strategies (Andres and Vallelado 2008; Staikouras et al. 2007).

The role of the board in the financial sector is more complicated due to the nature of the business. Becht et al. (2011, p.445) summarise this complexity as:

"*The root cause of the problem lies in the very nature of the business, which is fast moving, risky, and opaque, so that it is very difficult to ensure through bond covenants or other means of monitoring that creditors' money is not put at undue risk. Banks are in the business of taking risks; they can take on risk quickly and easily; they can mask, to some extent, how much risk they take. Their portfolios are often illiquid and hard-to-value, their positions shift rapidly, and their assets and liabilities can be extremely complex*".

The board of directors is one of the main corporate governance tools that effectively monitor the management (Adams et al. 2010). The main duty of the board is to look

out for the shareholders' interest and ensure that their goals are achieved (Pearce and Zahra 1992). Thus, the structure of the board of directors plays an important role in influencing the firm's output (Hardwick et al. 2011). The next section emphasises the role of the board of directors as a governance tool and a solution to the agency conflicts.

2.3 The Board of Directors as a Governance Mechanism

The previous discussion indicates that agency theory mainly discusses the conflicts arising from the divergence of interests in the agency relationships. However, corporate governance mechanisms work to make sure that these conflicts are reduced (Denis 2001). In this regard, Jensen (1993) highlights four corporate governance mechanisms, namely the legal and regulatory mechanisms, internal control mechanisms, external control mechanisms and product market competition. These mechanisms are expected to align the interests of shareholders with managers and protect firm resources from expropriation (Jensen 1993). The main internal control system in any corporation is the board of directors. Jensen (1993, p.40) describes the board as "*... the apex of the internal control system, has the final responsibility for the functioning of the firm. Most importantly, it sets the rules of the game for the CEO*".

According to agency theory, the board of directors is considered to be the main tool for shareholders to exercise control over the firm's management (Denis and McConnell 2003; Hermalin and Weisbach 1991; John and Senbet 1998; Johnson et al. 1996). The wide dispersion of the shareholder ownership structure makes it difficult for them to monitor the management (John and Senbet 1998). The board of directors is presumed to execute the monitoring role on behalf of the firm's shareholders (Pearce and Zahra 1992). According to Jensen (1993, p.40) the main role of the board is to "*hire, fire, and compensate the CEO, and to provide high-level counsel"*.

Moreover, Linck et al. (2008), Adams and Ferreira (2007) and Raheja (2005) suggest that the board of directors provides two important functions to the firm. The first function refers to monitoring and, in this case, the board should control and

observe the managerial actions. Proper monitoring ensures that shareholders' interests are protected, especially those of the minority shareholders, who have less power and incentive to monitor the management. The second function relates to advising: in this regard, the board provides the required assistance to implement good managerial decisions and successful strategy.

The degree of board effectiveness depends mainly on its composition and structure (Baysinger and Hoskisson 1990; Cochran et al. 1985; Kesner 1987; Mace 1971). For example, Mace (1971) indicates that the existence of the correct mix of both executives and non-executives determines the board's ability to perform the service role. Baysinger and Hoskisson (1990) note that the type of directors on the board, i.e. executives or non-executives, affects the implementation of firm strategy. Other studies provide evidence that the board structure affects the ability of the board to effectively monitor and control the management (Baysinger and Hoskisson 1990; Kesner 1987).

It is important to note here that some authors provide a definition for the term board structure/composition. For example, Pearce and Zahra (1992, p.412) define this term as it "*refers to the number of directors (hereafter 'board size') and type of members as determined by the usual insider or outsider classification*". Ellstrand et al. (2002, p.770) indicate that board composition is defined as "*typically refers to the proportions of inside directors (individuals employed by the firm) and outside directors serving on the board*". In this study, board structure refers to board size, board independence, i.e. number of independent directors relative to the board size, and CEO/Chairperson duality. In particular, these variables are the most debated in the corporate governance literature (Adams et al. 2010).

2.3.1 Board Structure and Corporate Risk Taking

The importance of studying risk taking in this study stems from the fact that any managerial decision involves a certain amount of risk. However, in most cases, risk and uncertainty are used interchangeably in a misleading way. In the seminal work of Knight (1921), the author differentiates between the two concepts. According to Knight (1921), both risk and uncertainty are present where the future is unknown. However, risk can be measured because the probability distribution of this future is known; while, in the case of uncertainty, the unknown probability distribution makes it difficult to measure. Nevertheless, Miller (1977, p.1155) notes that "*Not much attention is paid to this distinction today because in either case the future is unknown and decisions must be made using the individual's subjective estimates of the relevant probabilities*".

The focus of this study is how the board structure and the females on the board are related to the corporate risk taking. More specifically, the study examines the effect of board structure and female directors on idiosyncratic risk, which is also known as firm-specific risk[2]. The focus is on idiosyncratic risk because this component is highly likely to be related to and affected by the decisions of the directors on the board of directors (Jin 2002).

Corporate risk taking results from various decisions that are based on different incentives as well as different risk preferences (Kim and Buchanan 2008). From the agency theory perspective, these differences create conflicts in the principal-agent relationship, as indicated in section 2.1.1. From the finance theory perspective, the extensive literature on the asset pricing models has focused on the trade-off between risk and return. The asset pricing models in common drive a positive relationship between risk and return (Fama and French 2004). However, negative and insignificant findings are also reported in such trade-offs [3]. Despite these conflicting results, the common proxy for risk taking in the asset pricing models is the return volatility.

[2] In this study, idiosyncratic risk and firm-specific risk will be used interchangeably

[3] See for example, Nelson (1991), Chan et al. (1992), Campbell and Hentschel (1992), Whitelaw (1994).

Building on the work of Markowitz (1952) and the assumptions of modern portfolio theory, Sharpe (1963) and Lintner (1965) developed the most popular asset pricing model, CAPM. According to the CAPM model, the total risk of the firm is decomposed into two components. The first component presents the systematic risk, which is related to the market volatility. The second part presents the idiosyncratic risk (firm-specific risk), which is related to the firm's unique characteristics. Based on the modern portfolio theory assumptions, idiosyncratic risk can be eliminated through diversification. Therefore, the CAPM model assumes that the investor is either compensated by the risk free through investing in a risk-free asset or a risk premium which is captured by the firm's systematic risk component (Lintner 1965; Sharpe 1963).

Prior empirical papers have provided support for the CAPM model in explaining the cross variation in the stock returns (Fama and MacBeth 1973). The CAPM model provides a meaningful and powerful linkage on the risk return relationships. Moreover, Fama and French (2004, P. 25) note that "*Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centerpiece of MBA investment courses*".

However, the CAPM model is based on many simplifying assumptions that lead to poor empirical records. These assumptions raise many theoretical critiques against this model, especially its static nature, i.e. assuming a single period horizon. In addition, the variation in stock returns is only attributed to a single factor, which is the market. Another critical point in the CAPM model is that it relies on unconditional beliefs regarding the mean, variance and covariance, which means that the beliefs are the same over time; see Munk (2013) for a full review of asset pricing models. In addition to these theoretical critiques, recent papers provide evidence that other factors than the market may be able to provide superior results in stock return variation (see for example, Fama and French 1992, 1993).

To overcome the limitations in the CAPM model, several versions and extensions of this model have been developed (Levy 1978; Malkiel and Xu 2002; Merton 1987). These models try to capture the idiosyncratic risk where the investors are assumed to

hold undiversified portfolios for some exogenous reasons (Goyal and Santa-Clara 2003). Transaction costs and tax restrictions, for instance, may limit the investors' ability to fully diversify their holdings (Goetzmann and Kumar 2008). Nevertheless, the literature provides evidence that the traded assets (e.g. equity portfolios) face several difficulties for a complete diversification of the idiosyncratic risk component (e.g., Benartzi and Thaler 2001; Goetzmann and Kumar 2008; Huberman 2001). The problem of diversification intensifies with respect to the non-traded assets such as human capital (Goyal and Santa-Clara 2003).

Furthermore, Goyal and Santa-Clara (2003, p.977) argue that "*When the risk of the non-traded assets increases, the investors are less willing to hold other traded risky assets*". This statement hold true provided that there is no negative correlation between traded and non-traded assets. Consequently, the investors will ask for a higher return in order to hold the market portfolio of the traded assets, i.e. they become more risk averse. As the human capital is tied to a specific firm, which is the employer's firm, therefore, its value varies with the value of the employing firm. Heaton and Lucas (2000) provide evidence that the large part of entrepreneurial income is considered to be un-diversifiable risk, which is associated with common stock returns.

Another point is also related to the effect of stock return volatility on the firm's debt and equity. Black and Scholes (1973) and Merton (1974) view the firm's equity as a call option on the value of the firm's assets with an exercise price equal to the firm's total debt outstanding. Thus, an increase in the variance of the firm's assets leads to an increase in the value of the equity at the expense of the debtholders. Goyal and Santa-Clara (2003) indicate that the increase in the idiosyncratic risk affects the split of asset values between equity holders and debtholders. This is consistent with the risk-seeking behaviour of the firm's equity holders. In contrast, the debtholders have an incentive to decrease the variance of the firm's assets in order to maximise their debt claim (Goyal and Santa-Clara 2003).

The discussion above implies several important points. The firm's shareholders are more able to diversify their holdings efficiently. This is clearly reflected in their idiosyncratic risk-seeking behaviour, which maximises their holdings' value.

However, the firm's mangers, with the high non-diversifiable human capital, become more risk averse. This non-diversifiable risk limits their ability to diversify their personal portfolio. Accordingly, the firm's managers have incentives to reduce the variance of the firm's assets that they manage in order to reduce the riskiness of their personal wealth portfolio. The firm's debtholders are also interested in reducing the volatility of the firm's assets to avoid the negative consequences on their claims.

Turning to the topic of the board of directors, it is a legal requirement for every listed company to have one (Denis 2001). In addition, the board of directors determines the firm risk taking through carrying out all the strategic investment decisions. In the UK, the corporate governance code 2010 states, "*Every company should be headed by an effective board which is collectively responsible for the long-term success of the company*". Moreover, the main principle in the UK code indicates the main role of the board as:

"*The board's role is to provide entrepreneurial leadership of the company within a framework of prudent and effective controls which enables risk to be assessed and managed. The board should set the company's strategic aims, ensure that the necessary financial and human resources are in place for the company to meet its objectives and review management performance. The board should set the company's values and standards and ensure that its obligations to its shareholders and others are understood and met. All directors must act in what they consider to be the best interests of the company, consistent with their statutory duties*" (UK Corporate Governance Code 2010, p.9).

In UK companies, generally the board of directors consists of a mix of executive and non-executive directors. The executive directors include both the CEO and the firm's senior managers. The role of executive directors is to invest their knowledge, skills and experience to enhance the value of the firm (Ellstrand et al. 2002). In addition, it is expected that they have more information than the non-executive directors as they are running the daily operation of the firm (Johnson et al. 1996). Therefore, they are considered to provide the main input that provides other members with important information. Further, their ability to evaluate the CEO's

performance is expected to be better than that of other members (Hermalin and Weisbach 1991). However, Hermalin and Weisbach (1991) point out that insiders are also agents whose interests are not necessarily aligned with the shareholders. Moreover, in most cases, the CEO chooses the board members and controls the board decisions, which affects the monitoring function of insiders, who find themselves unable to criticise the CEO's performance.

Non-executive directors are professional members and, most importantly, they are independent from management (John and Senbet 1998). These members usually hold other senior positions in other public listed firms, special organisations or even academic centres. Fama (1980) argues that non-executive directors are disciplined by the external market. Accordingly, they effectively monitor the management of the firm as they care about their own human capital. In other words, they try to develop their reputation in the market as experts in decision control (Fama and Jensen 1983b). It is expected, therefore, that the boards that are dominated by non-executive directors will be more independent (Hermalin and Weisbach 1991; John and Senbet 1998; Johnson et al. 1996).

The board meeting is managed by the CEO, who could be either an executive or a non-executive director. Generally, the CEO is responsible for preparing the agenda to be discussed by the board (Jensen 1993). In addition, the CEO is the main source of information that is provided to other directors (Hermalin and Weisbach 1991). However, providing limited and specific kinds of information on the part of the CEO will affect the monitoring and evaluating functions of the other directors on the board (Jensen 1993). This issue may be exaggerated, especially when the titles of CEO and chairperson of the board are held by the same person. This leadership style, which is also known as CEO duality, may lead to a board culture problem. According to Jensen (1993, p.41), "*The great emphasis on politeness and courtesy at the expense of truth and frankness in boardrooms is both a symptom and cause of failure in the control system*".

Corporate governance studies extensively examine the roles and effects of the board of directors on firms' outcomes. Mainly, these studies focus on the structure of the board in relation to independence (Fich 2005; Hermalin and Weisbach 1988; Linck

et al. 2008), the relationship between board structure and directors' ownership (Denis and Sarin 1999; Simpson and Gleason 1999), what determines the board size (Boone et al. 2007; Guest 2008; Lehn et al. 2009; Raheja 2005), board structure and directors' pay (Guest 2010), and the effect of board structure on firm performance (Baysinger and Butler 1985; Dahya and McConnell 2007; Haniffa and Hudaib 2006; Hermalin and Weisbach 1991; Vafeas and Theodorou 1998).

However, only a few studies examine the board characteristics and risk taking. The next section reviews the board structure variables, i.e. board size, independence and CEO/Chairperson duality, with respect to the corporate risk taking.

2.3.1.1 Board Size and Corporate Risk Taking

Board size relates to the total number of directors serving on the board in any corporation. Determining the optimal size of the board is an important aspect of an efficient corporate governance system (Jensen 1993). The number of directors on the board influences the effectiveness of the decision-making process and therefore the firm's outcomes (Lipton and Lorsch 1992). In essence, the main role of the board is to hire, fire and compensate top management as well as protect the interests of the shareholders (Jensen 1993). The number of directors on the board affects their monitoring function (Yermack 1996). However, as more directors are added to the board the costs may exceed the benefits (De Andres et al. 2005). Lipton and Lorsch (1992) indicate that, as the number of directors on the board increases, the coordination and communication costs also increase. This negative effect from adding more directors will in turn reduce the benefits from having more human resources and different perspectives on the board (Jensen 1993).

The findings of Lipton and Lorsch (1992) show that a board that exceeds 10 members tends to be ineffective. The reaction of the market seems to be consistent with the previous arguments. Yermack (1996) finds that the corporate value in terms of profitability and asset utilisation decreases as the board size increases. In the same manner, Bhagat and Black (1996) support both the argument of Jensen (1993) and the findings of Yermack (1996). Mak and Li (2001) contend that better monitoring and fewer free-rider problems are associated with smaller boards.

These findings indicate that smaller boards create value for the shareholders of the firm. In contrast, larger boards suffer from coordination and communication problems. Therefore, they tend to be less powerful and useful regarding the firm's decision process. Hermalin and Weisbach (2003) in their review assert that smaller boards influence managerial decisions to be in the interest of the firm's shareholders and they are more able to replace poor managers.

From a different point of view, some authors find that larger boards could enhance the firm's performance since larger boards include more human resources which provide knowledge and experience (John and Senbet 1998). Further, larger boards enhance the firm's ability to access more resources at lower costs (Pearce and Zahra 1992). In addition, for the CEO it becomes more difficult to dominate boards with a larger number of directors (Forbes and Milliken 1999). The proponents of large boards find evidence for effective decision making as the quality of advice is enhanced, especially in larger firms (Forbes and Milliken 1999; Haniffa and Hudaib 2006).

In the UK, the recent UK Corporate Governance Code (2010) does not determine a specific number for directors on a board; however, the recommendations clearly support a reasonable number, which should not to be too large. In section B.1, the code states that "*The board and its committees should have the appropriate balance of skills, experience, independence and knowledge of the company to enable them to discharge their respective duties and responsibilities effectively*". In addition, the supporting principle explains this statement as:

"*The board should be of sufficient size that the requirements of the business can be met and that changes to the board's composition and that of its committees can be managed without undue disruption, and should not be so large as to be unwieldy*" (UK Corporate Governance Code 2010, p.12)[4].

The effect of board size on corporate performance variability could be backed by different theories. From the agency theory perspective, Jensen (1993) indicates that

[4] To access the UK corporate governance code 2010:https://www.frc.org.uk/getattachment/b0832de2-5c94-48c0-b771-ebb249fe1fec/The-UK-Corporate-Governance-Code.aspx

larger boards suffer from more communication and coordination problems. These problems make the board meetings more difficult to organise and it is even not easy to reach a consensus. The effect on performance variability appears in a slower decision-making process and the board decisions tend to be less extreme. Cheng (2008, p.159) explains that larger boards "*moderate the extremity of board decisions, as it takes more negotiation and compromise for a larger board to reach a final decision*".

These arguments are also supported in the economics and social psychology literature. For example, Sah and Stiglitz (1986) and Sah and Stiglitz (1991) indicate that individuals' opinions and evaluations tend to be heterogeneous based on their different experience and background. The final decision is viewed as a compromise that reveals all these differences among individuals. Therefore, more risky projects are usually rejected. This is because they need to be accepted by a large number of directors on the board. Social psychology studies show support to the previous arguments. In particular, these studies analyse the extremity and riskiness of group decision making. The results confirm that larger groups take average decisions, i.e. less extreme ones (Kogan and Wallach 1964; Moscovici and Zavalloni 1969). Accordingly, too bad or too good decisions are rejected.

The empirical evidence from the non-financial sector supports the above arguments. For instance, Cheng (2008) provides evidence from the US non-financial market. The author confirms the negative relationship between board size and the variability in monthly stock returns, annual accounting return on assets, and Tobin's Q. The sample of the study covers 1,252 non-financial US firms over the period 1996–2004. Cheng (2008) indicates that this negative relationship is in line with group decision-making studies, as, in large groups, it is more difficult to reach a consensus, and this results in less extreme decisions. Moreover, the study raised an important question on the existence of large boards if they lead to lower firm value. Building on the prior work of Raheja (2005), Coles et al. (2006), and Harris and Raviv (2008), the author contends that under certain exogenous conditions a larger board could be ideal mainly in large and complex firms. In terms of methodology, the study employs within-firm, over-time variability by averaging all the explanatory variables

in the model. To control for endogeneity, the study replaces all the average values of board variables by the first valid observation of the firm during the sample period.

Consistent with Cheng (2008), evidence from China has been provided by Chen (2011). In this study, the sample covers only the non-financial firms over the period 2002-2008. The author examines the relationship between board size and corporate risk taking using only one accounting risk measure, which is standard deviation of corporate profitability. However, the main estimation method was cross-sectional analysis and the study did not control for the endogeneity problem.

From Japan, similar evidence has been provided by Nakano and Nguyen (2012). The study covers 1324 non-financial firms listed on the Tokyo Stock Exchange over the period 2003-2007. An important concern of this study is to investigate the moderating effect of the growth opportunity in the board size-risk-taking relationship. The study argues that the effect of board size will differ among firms depending on the availability of investment opportunities. Initially, the findings confirm the negative relationship between board size and firm risk taking. However, the significance of this effect is lower than the one reported from the US studies. Moreover, the authors argue that a larger board may not lead to lower performance variability, since the effect of board size on performance variability is affected by the availability of investment opportunities. With more investment opportunities, the chance also increases to select a greater number of risky investments even when boards are large.

Wang (2012) constructs a sample of an unbalanced panel of 1,618 industrial US firms over the period 1992-2004. The study aims to examine how the board size is related to the risky policy choices in the firm. To proxy for risky policy choices, Wang (2012) uses four different measures. The first one is incentive components of CEO compensation measured as the change in the CEO's wealth relative to stock price and the change in the CEO's wealth relative to stock return volatility. Second, the study uses research and development expenditure scaled by assets and capital expenditure scaled by assets to proxy for the firm's investment policy. Third, the study uses leverage to proxy for debt policy. The final dependent variable is the

standard deviation of monthly stock returns over 12 and 24 months to proxy for future firm risk.

Wang (2012) uses the lagged values of the explanatory variables to mitigate the effect of endogeneity. In addition, the study includes the industry and year fixed effect to control for unobservable heterogeneity, and in the analysis the standard error is estimated as clustered on firm level and as robust to heteroscedasticity. The findings indicate a negative relationship between board size and firm risk. The study shows that smaller boards create value and offer higher incentives to the CEOs to take more risk. Further, the findings reveal that smaller boards are associated with higher risky investment and future risk but with lower leverage. It is important to note that the negative effect of board size on firm risk is robust to different sensitivity tests. More importantly, the study repeats the analysis using the dynamic panel estimator and the findings confirm the negative effect.

Unlike Cheng (2008) and Nakano and Nguyen (2012), it is noticeable that Wang (2012) considers the dynamic endogeneity in the analysis even though the results are similar. Through applying the dynamic panel estimator the study controls for three types of endogeneity, namely simultaneity, unobserved heterogeneity and dynamic endogeneity.

Recently, Koerniadi et al. (2014) have provided consistent evidence from New Zealand. The study covers only 82 industrial firms over the period 2004-2008. The study basically examines how the board size and independence affect corporate risk taking. However, only one risk measure is used in the analysis, which is the standard deviation of monthly raw returns. Using OLS and fixed effect methods, the authors report a negative and significant relationship between board size and corporate risk. Additionally, the study conducts a Durbin-Wu-Hausman test to detect the presence of endogeneity. According to Koerniadi et al. (2014), the test result indicates no presence of endogeneity in their analysis.

In the UK, to my knowledge only two empirical studies examine the board structure in relation to corporate risk taking. One is by McNulty et al. (2013), who examine the board process and structure on corporate risk during the recent financial crisis.

The study employs qualitative and quantitative approaches to examine how the structures and processes of boards at the onset of the crisis period are related to the financial risk during the crisis. To collect information on board effectiveness, a questionnaire was developed and sent to the board chairs of the largest 1000 UK non-financial firms. Using principal component analysis, the questionnaire items on board effort norms, cognitive conflict, use of knowledge and skills, and cohesiveness were processed to produce meaningful scores.

McNulty et al. (2013) match the data collected from the questionnaire responses with data on other board characteristics such as board size, the percentage of non-executive directors, CEO/Chairperson duality, risk/audit committee and executives' pay. Further, the study uses the change in financial risk from the pre-crisis (2007) to the crisis (2009) as the main risk measure. The OLS results document a negative relationship between board size and financial risk. However, both the proportion of non-executive directors and CEO/Chairperson duality are insignificantly related to the financial risk during the crisis period. The study concludes that risk management is a complex process, which is not only a technical issue but also other social and subjective factors affect this process as well. While this study focused only on the largest UK non-financial firms, the results may be driven by this bias, i.e. hold for large firms and not be generalisable to small firms or others sectors as well.

Gonzalez and André (2014) construct a sample of 916 non-financial UK public firms over the period 1992-2010. The study uses the short-term beta as the main risk measure, i.e. market risk, which is totally different from this study. The focus of this study is on idiosyncratic risk since it is more relevant and controllable by the board of directors. Further, Gonzalez and André (2014) use factor analysis to create effective board variables which include board size, the percentage of non-executive directors, experience and directors' shareholding. With respect to the board size, the findings document a positive relationship between board size and short-term beta. The study relies on OLS estimates in the analysis and does not control the endogeneity, which may bring the findings of the study into question.

Despite the few studies that cover the financial sector, the results from the financial sector seem to be consistent with the evidence from the non-financial sector. The

negative effect of board size on corporate risk is confirmed by several studies. For example, as evidence for the largest US bank holding companies, Pathan (2009) examines the effect of board size on risk taking. The sample covers 212 banks over the period 1997-2004. Further, risk taking is measured by five different measures, namely total risk, idiosyncratic risk, systematic risk, asset return risk, and insolvency risk. After controlling for bank size, charter value, leverage, frequency of trading and previous merger activity, board size appears negative and significant across the five risk measures.

Pathan (2009) explains that small boards serve the shareholders' interests by enhancing more risky investment. The study uses the lagged value for all the explanatory variables in the empirical model to control for the endogeneity. In addition, different sensitivity tests are provided and the negative relationship remains robust. However, one of the notable limitations of the study is the sample selection: the sample focuses on largest bank holding companies (BHC) only while this may create generalisability problems to smaller firms.

Houssem and Ines Ghazouani Ben (2011) employ generalised least square random effect and one-step GMM estimator in their study. The study examines the board size and risk taking measured by z-score. The results suggest that larger boards lower bank risk. However, the sample of this study only includes 11 Tunisian commercial banks over the period 1997-2006. One noticeable issue in this study may be the sample selection bias, since it focuses only on the largest banks in Tunis, which may create generalisability problems.

Tao and Hutchinson (2013) provide inconsistent results with the previous studies in the financial sector. The study covers the Australian financial sector for the years 2006-2008. The sample of the study includes financials firms, banks, insurance, real estate and real estate investment trusts companies; the final sample consists of 317 firms. The focus of the study was on the importance of board committees in managing and monitoring corporate risk as well as on firm value. In particular, the study examines the structure of compensation and risk committees. The study uses Beta as the main risk measure and earnings per share to proxy for corporate performance.

Tao and Hutchinson (2013) use factor analysis to find a factor score for both committees. The factor score examines independence, experience, tenure and number of meeting held by these committees. In addition, the study examines the dual role of directors who serve in both compensation and risk committees. The findings indicate a positive relationship between compensation committee and risk. Moreover, when the compensation committee includes more independent directors; with high skills and experience, and who frequently meet together, this leads to better risk management and higher firm performance. The findings also show that the dual role in both compensation and risk committee results in higher monitoring which leads to higher corporate performance. The board size, which was used in the study as a control variable, has no impact on risk measure. It is worth noting that the study employs random effects generalised least square as the main estimation method. Moreover, the study applies Durbin-Wu-Hausman test and reports that no endogeneity problem exists in the model.

2.3.1.2 Board Independence and Corporate Risk Taking

In the UK, like many countries around the world, the board of directors is comprised of executive and non-executive directors. According to agency theory, a board dominated by outsiders – non-executives – can reduce the agency problem by effective monitoring (Jensen and Meckling 1976). Fama (1980) and Fama and Jensen (1983b) argue that outside directors – non executives – create value for the firm as they have more expertise and knowledge. In addition, they work with shareholders' interests through their effective monitoring role. Further, Fama and Jensen (1983b) argue that non-executive directors are viewed as effective monitors of the firm because they work to protect their human capital reputation in the market as experts in decision control.

Agency theory supports the increased number of non-executive directors on the board as they are expected to be aligned with firm shareholders and therefore enhance the value of the firm (Dalton et al. 1998; Eisenhardt 1989; Fama and Jensen 1983b; Jensen and Meckling 1976). The ability of non-executive directors to be effective monitors refers to three reasons. The first one is related to their independence, since they review the board and firm performance in a way that is

different to that of executives, who are expected to be more inclined to side with the CEO (Jensen 1993). The second reason is that the non-executive directors are legally responsible to serve the shareholders' interests and could be liable if they fail to do so. The last reason, as mentioned before, is that they care about their reputation in the market as effective and professional monitors (Fama and Jensen 1983b). Thus, those directors prefer to send positive signals to the external labour market (Fama 1980)

Several empirical papers provide evidence supporting the previously mentioned arguments. For example, Baysinger and Butler (1985) and Weisbach (1988) among others report that boards with a high percentage of non-executives tend to be more effective in monitoring, leading the managers to take action in the best interests of shareholders, and actively replacing the CEO after poor performance results. Other authors find that boards that are dominated by non-executive directors lead to superior firm performance due to the knowledge and experience that they acquire (e.g. ,Weir et al. 2002).

The UK Corporate Governance Code (2010, p.11) states that at least half of the board should be independent non-executive directors. In addition, the code specifies the main duties of non-executives by saying in section A.4: "*As part of their role as members of a unitary board, non-executive directors should constructively challenge and help develop proposals on strategy"*. Further, the supporting principle provides more details on these duties:

"*Non-executive directors should scrutinise the performance of management in meeting agreed goals and objectives and monitor the reporting of performance. They should satisfy themselves on the integrity of financial information and that financial controls and systems of risk management are robust and defensible. They are responsible for determining appropriate levels of remuneration of executive directors and have a prime role in appointing and, where necessary, removing executive directors, and in succession planning*".

More importantly, the 2010 UK code determines when a director is considered to be a fully independent one. When a director sits on the board as a monitor for the

management actions, there should be no relations or benefits with this firm. These benefits or relationships will definitely affect his/her objectivity and monitoring function. According to the recent UK code, for the director to be independent he/she must not have been employed within the last five years in the firm or one of its groups. Further, there should be no business relationships within the last three years, either direct or indirect ones. Likewise, the director should not receive any form of additional remunerations except his/her director's fee. Additionally, there should be no family or directorship connection with any of the firm's managers or employees. Finally, the independent director should not be a major shareholder in the firm or serve more than nine years on the board from the first time of his/her appointment (UK Corporate Governance Code 2010).

Despite the importance of the roles of non-executive directors on the board, many studies indicate that they could be ineffective monitors. The first issue is the lack of time, since non-executive directors are already directors on other boards (Mace 1971). Therefore, most of the time they are busy especially when they hold multiple directorships at the same time. Secondly, given the fact that top management, in particular the CEO, interfere in the selection and the appointment of non-executive directors, the board may become as a 'rubber stamp' (Pfeffer 1972; Shivdasani and Yermack 1999). In other words, its ability to criticise the decisions and project selection will be less effective. Thirdly, the non-executive directors may exercise their role with too much monitoring, which in turn could negatively affect corporate performance (Baysinger and Butler 1985). Finally, non-executive directors may lack independence, and so not perform their duties correctly (Demb and Neubauer 1992).

However, the empirical evidence on the value of non-executives is mixed and inconclusive. Several papers fail to find any significant relationship between non-executive directors and firm performance (Bhagat and Black 2000; De Andres et al. 2005; Haniffa and Hudaib 2006; Hermalin and Weisbach 1991). For example, Hermalin and Weisbach (1991) investigate this relation in a sample of 142 US firms and find no significant relation between the non-executive directors and firm value. However, they clarify their results as follows: if boards are optimally weighted between outsiders and insiders so that both groups have several advantages, in equilibrium there would be no cross relation between composition and performance.

However, other papers report a positive effect of non-executives on firm performance (e.g,Weir et al. 2002). In contrast Agrawal and Knoeber (1996), Yermack (1996) among others find that the non-executive directors negatively affect firm performance.

The effect of board independence on corporate risk taking seems to be mixed and not clear. Agency theory argues that the non-executive directors effectively monitor the firm's management (Fama and Jensen 1983b; Jensen and Meckling 1976). Therefore, it is expected that they will work in the interests of shareholders and enhance more risky investments (Raheja 2005). It is known that insider managers tend to be more risk averse due to employment concerns (Amihud and Lev 1981; Eisenhardt 1989). Shareholders who are well diversified as they can invest in more than one firm have a tendency for excessive risk taking (Jensen and Meckling 1976). Accordingly, the role of non-executive directors is very important in moderating the decisions of insiders (Raheja 2005).

However, the non-executive directors may also reduce the corporate risk taking. Fama and Jensen (1983b) argue that non-executive directors try to send a positive signal to the market about their role on the board. Being a good monitor and expert in control systems will improve their reputation in the market (Fama 1980). Building on this reputation hypothesis, non-executive directors may choose less risky decisions to avoid firm failure or lawsuits (Pathan 2009). Additionally, according to the monitoring hypothesis, more independent boards are expected to lower corporate risk (Prendergast 2000; Raheja 2005). It has been suggested that the monitoring role is less effective in uncertain environments (Brick and Chidambaran 2008). In uncertain environments, the information asymmetry is high; thus the information cost is high in these environments. Within this context, the non-executive directors, who lack the details and specific information, will find it difficult to evaluate the firm's investment decisions (Smith Jr and Watts 1992). Consistent with the negative effect of non-executive directors on corporate risk, Cheng (2008) suggests that non-executive directors who come from a different background may have different views and perspectives and thus may moderate the board decision regarding risky choices.

From the non-financial sector, Brick and Chidambaran (2008) examine the relationship between board independence and volatility in the stock return. In this study, board monitoring (independence) is measured by two proxies: the number of independent directors and the percentage of independent directors on the board. Using 4,162 observations from the US over the period 1996 to 2003, the study reports a negative relationship between board independence and firm risk. In addition, this negative effect was found in the absence of external regulations. The authors also examine the same relationship after the Sarbanes–Oxley Act and find the same negative effect. However, they argue that the sensitivity of the negative relationship between board monitoring and risk decreases in the presence of external regulations. Moreover, the results of Brick and Chidambaran (2008) provide evidence that high-risk firms comply more to the external regulations and increase the level of monitoring on their board more than low-risk firms.

In the UK, McNulty et al. (2013) report that the proportion of non-executive directors had no impact on financial risk during the recent financial crisis in the UK's largest firms. However, Gonzalez and André (2014) report a negative relationship between the proportion of non-executive directors on UK boards and the short-term beta. From the non-financial sector, some papers report an insignificant relationship between board independence and corporate risk taking (Chen 2011; Cheng 2008; Koerniadi et al. 2014).

The negative effect of non-executive directors is also found in the financial sector studies. For example, Pathan (2009) report a negative relationship between non-executive directors and risk taking. According to Pathan (2009), the negative relationship was found across all the bank risk measures except the insolvency risk measure. The results show that non-executive directors tend to be more sensitive in complying with regulations. Accordingly, they avoid risky investments that may lead to the bank failure.

Erkens et al. (2012) use 296 of the world's largest financial firms across 30 countries. This study is considered to be one of the few studies that cover the whole financial sector. Their sample includes banks, brokerage firms and insurance companies. The study mainly examines the effect of board independence,

institutional ownership and large shareholders on firm value and risk taking. According to Erkens et al. (2012) results, non-executive directors have no significant effect on corporate risk. Likewise, Houssem and Ines Ghazouani Ben (2011) report an insignificant relationship between non-executive directors and bank risk taking in Tunis.

2.3.1.3 CEO/Chairperson Duality and Corporate Risk Taking

In general, the main functions of the board chairperson are managing board meetings, and supervising the procedure of hiring, firing, and determining the CEO's compensation (Jensen 1993). However, the CEO is mainly responsible for running the firm's daily operation. If the two positions are held by the same person, this is described as duality. In practice, most of the codes and recommendations of corporate governance call for the separation of the two titles. For example, the UK Corporate Governance Code (2010, p.10) recommends in section A.2:

"*The roles of chairman and chief executive should not be exercised by the same individual. The division of responsibilities between the chairman and chief executive should be clearly established, set out in writing and agreed by the board"*.

According to agency theory, combining the two roles will negatively affect corporate performance since the CEO will have too much power. Therefore, the board will be dominated by the CEO and will be less effective in its monitoring function (Fama and Jensen 1983b; Jensen 1993). Further, Jensen (1993) argues that duality may intensify the agency problem and increase agency cost. Therefore, within the context of agency theory, separating the two positions will improve board independence and limit the opportunistic managerial behaviour (Haniffa and Cooke 2002; Lipton and Lorsch 1992). However, duality gains support from the stewardship theory. According to Stewart (1991), the dual role on the board may improve the decision-making process and consequently enhance corporate performance. Additionally, combining the two positions gives the CEO the chance to direct all his/her effort towards firm objectives with minimal board intervention (Dahya et al. 1996).

The empirical evidence on the CEO/Chairperson duality provides inconsistent results. For example, some studies find that CEO/Chairperson duality negatively affects corporate performance (Daily and Dalton 1994; Pi and Timme 1993; Rechner and Dalton 1991), while other papers report a positive effect of CEO/Chairperson duality on corporate performance (Boyd 1995; Haniffa and Hudaib 2006). In addition, some papers report no significant relationship (Brickley et al. 1997; Elsayed 2007; Griffith et al. 2002).

As mentioned previously, the literature has extensively studied the CEO/Chairperson duality effect on corporate performance while little attention has been paid to corporate risk taking. However, corporate risk taking is an important aspect of the strategic management and the cornerstone in most of the managerial decision-making process. According to agency theory, managers tend to be more risk averse while shareholders are risk neutral (Jensen and Meckling 1976). Therefore, managers tend to choose less risky investments because they want to secure their positions since this is their main concern (Baysinger and Hoskisson 1990; Kochhar and David 1996; Zahra 1995). Based on these arguments, it is expected that, with the power concentration in the manager's hand, most of the decisions will serve his/her interest. Duality may lead to a lower level of risk taken by the managers (Demsetz and Lehn 1985). The managerial tendency towards risk aversion combined with low board monitoring will eventually lead to lower firm risk taking (Kim and Buchanan 2008).

Another stream in the literature assumes that, with more power concentration in the CEO's hands, corporate risk taking will increase. Adams et al. (2005) hypothesise that a more powerful CEO will lead to more performance variability. The authors build their assumptions on the ideas provided in the economic literature (Sah and Stiglitz 1986; Sah and Stiglitz 1991). Sah and Stiglitz (1986) and Sah and Stiglitz (1991) propose a model that examines how group decision making is affected by diversification of opinion. This model shows that extreme projects that are too good or too bad are highly likely to be rejected in larger groups. This is because they require agreement from several members in the group to be accepted. Accordingly, Adams et al. (2005) infer from this theory that, when the number of directors who take the decision increases, the performance variability should decrease. Therefore,

when the CEO is also the chairperson of the board, it is expected that the corporate risk will increase (Adams et al. 2005).

One piece of evidence from the non-financial sector has been provided by Kim and Buchanan (2008). This study covers the largest US non-financial firms and only examines one year, 2002. The corporate risk is measured by the income stream risk and the main analysis is conducted using hierarchical regression. The authors report a negative relationship between CEO/Chairperson duality and corporate risk. According to Kim and Buchanan (2008), the negative effect may be attributable to the managerial risk-aversion tendency which is backed by agency theory. However, it is worth noting that there is no treatment of the endogeneity problem in their analysis, which may bring the validity of the study findings into question.

Adams et al. (2005), on the other hand, find a positive relationship: they report that firm variability increases as the power of the CEO increases. In their study, they use three measures for CEO power: a dummy if the CEO is also the founder, if the CEO is the only insider on the board, and if both titles of CEO and chairperson are held by the same person. The study focuses on 336 US non-financial firms, over the period 1992-1999. The authors report the positive effect of CEO/Chairperson duality on the three measures of CEO power they adopt. Further, they explain their results within the context of group decision-making literature, as explained above, not from the agency theory perspectives. Furthermore, Cheng (2008) and Chen (2011) find that the CEO/Chairperson duality has no impact on corporate risk taking. Both studies report their results using data from the non-financial firms. From the UK, McNulty et al. (2013) report an insignificant effect between CEO/Chairperson duality and corporate risk.

The evidence from the financial sector is limited. For example, Pathan (2009) finds a negative relationship between CEO duality and corporate risk taking. The study uses two measures to proxy for CEO power: a dummy variable when the roles of CEO and chairperson are combined, and another dummy if the CEO is internally hired. The authors confirm this negative effect using several robustness tests that control for possible endogeneity effect. Further, Pathan (2009) explains this negative effect within the context of agency theory where managers behave in a more risk-

averse manner due to the employment risk. In contrast, Lewellyn and Muller-Kahle (2012) find a positive relationship between CEO power and risk taking using 74 US firms in the subprime mortgage industry. This study uses agency theory and the approach/inhibition theory of power from the social psychology literature. The study reports that certain features of CEO power such as CEO ownership, expert power, structural and prestige power increase the chance that the CEO takes more risky decisions.

In summary, the review of empirical papers that examine the effect of board structure on corporate risk taking reveals several important gaps in the literature. In the first place, the number of empirical studies in this area is clearly limited and this explains the few papers that were discussed in the empirical review. In addition, the review indicates the need for this study in the UK since all the above studies come from the US market (Adams et al. 2005; Cheng 2008; Erkens et al. 2012; Kim and Buchanan 2008; Lewellyn and Muller-Kahle 2012; Pathan 2009), China (Chen 2011), Japan (Nakano and Nguyen 2012), New Zealand (Koerniadi et al. 2014) and Tunis (Houssem and Ines Ghazouani Ben 2011). However, as discussed in the first chapter, the differences in corporate governance arrangements, codes' rules and regulations between countries justify the need for more country-specific studies.

Further, the discussion of the empirical papers indicates that the evidence from the financial sector is limited. With the exception of Erkens et al. (2012), none of the papers mentioned above cover the whole financial sector. For instance, these papers mainly focus on banks only and ignore the other financial institutions (Houssem and Ines Ghazouani Ben 2011; Lewellyn and Muller-Kahle 2012; Pathan 2009). To the best of my knowledge, this study is the first in the UK that investigates the effect of board structure on corporate risk in the financial sector. The sample of this study includes banks, insurance companies, real estate and financial service firms.

The corporate governance literature documents that the board structure is endogenously determined (Hermalin and Weisbach 1988, 1991, 1998). Further, Wintoki et al. (2012) argue that endogeneity in the board structure relationships arises from three sources, namely unobserved heterogeneity, simultaneity and dynamic endogeneity. The authors add that most of the empirical papers control for

unobserved heterogeneity and simultaneity but unfortunately most of them ignore dynamic endogeneity. Therefore, the estimation method used in examining the board structure on corporate risk is very important. The normal estimation methods such as OLS and fixed effect fail to control for all the endogeneity sources (Wintoki et al. 2012). Thus, part of the inconclusive results could be attributed the methodological issue.

The empirical review reveals that some papers do not control for the endogeneity problem at all (Chen 2011; Kim and Buchanan 2008). Moreover, none of the above studies employ a dynamic panel estimator in the estimation method. Houssem and Ines Ghazouani Ben (2011) employ the one-step generalised method of moments (GMM) in their study; however, while this dynamic estimator may provide superior results than the traditional estimation methods, still it suffers from several shortcomings. In this study, and following Wintoki et al. (2012), the analysis is performed using the two-step generalised method of moments, which is known as system GMM[5].

2.3.2 Board Structure and Corporate Risk Taking during the Recent Crisis

The recent financial crisis serves as a wake-up call that requires quick corporate governance reform and intervention (Goergen 2012). The recent crisis (2007-2009) has been described as the worst global crisis since the Great Depression (Kirkpatrick 2009). The negative consequences of the crisis globally have affected most of the international capital markets, employment rate, and consumer spending among other things, (Adams 2012; Erkens et al. 2012; Goergen 2012). Adams (2012) suggests that the current crisis is different from the previous ones, since most of the previous crises hit emerging markets and this one initiated in the US economy. The American economy is characterised by strong corporate governance and legal system (Adams 2012).

Many scholars agree that corporate governance mechanisms fail to perform their duties even in a developed economy such as the US. The board of directors is cited

[5] The differences between one-step and two-step generalised method of moments are explained in more detail in the Methodology chapter.

on the top of the weaknesses in the firms' governance system (Conyon et al. 2011). Furthermore, poor risk management, improper managerial compensations and irresponsible risk taking also led to the recent crisis (Conyon et al. 2011; Erkens et al. 2012; Kirkpatrick 2009; Pathan 2009; Spong and Sullivan 2012).

In the financial sector – where the recent crisis initially started – one of the main factors that contributed to the failure of financial institutions during the crisis was excessive risk taking (Erkens et al. 2012). The remuneration system, which provides the executives of financial institutions with large monetary incentives, intensifies their tendency to take on more risk (Spong and Sullivan 2012). As a result, the board of directors becomes the central focus of the corporate governance discussions (McNulty et al. 2013). Most of the corporate governance codes emphasise how the board of directors should be more effective, particularly in managing firm risk (Adams 2012).

In the UK, the Walker Report (2009, p.12), which was directed at the financial institutions, clearly specifies that the "*board-level engagement in risk oversight should be materially increased, with particular attention to the monitoring of risk and discussion leading to decisions on the entity's risk appetite and tolerance*". Likewise, the recent UK corporate governance code (2010) stresses the importance of board responsibility for risk management. Several related papers have considered the effect of board structure during the recent financial crisis. However, the majority of these papers focus on the corporate value while very limited research has been conducted regarding corporate risk. Additionally, most of the empirical papers that have studied the board structure during the recent crisis rely on data from the US. The findings of these papers in general are mixed and inconclusive.

For example, Adams (2012) uses several corporate governance characteristics to compare the governance quality of financial and non-financial US firms. The governance score in this study considers the board size, board independence, directorship, directors' attendance and CEO compensations. Surprisingly, the findings suggest that the quality of governance characteristics is comparable between the two sectors. This implies that the governance in the financial institutions did not fail and contribute to the crisis as suggested by policymakers and

regulators. Moreover, Adams (2012) finds that large financial institutions with a higher ratio of independent directors had more losses during the crisis. According to Adams (2012), this finding suggests that the focus should be not on the number of independent directors on the board but on their qualifications and skills.

Beltratti and Stulz (2012) provide evidence from an international sample of large financial institutions in 31 countries that strong governance did not lead to better performance in the crisis period. In this study, the results suggest that banks with strong governance (in terms of shareholder-friendly boards) suffered more during the crisis. Similarly, Erkens et al. (2012) cover 296 financial institutions from 30 countries during the recent financial crisis. The study defines the crisis period as 2007-2008 and examines the effect of board independence and institutional ownership on corporate value and risk. The findings indicate that financial institutions with more independent directors and greater institutional ownership performed worse during the crisis. In addition, the study finds that financial institutions with higher institutional ownership took higher risks at the onset of the crisis. Moreover, no significant relationship was found between independent directors and corporate risk before or during the crisis.

McNulty et al. (2013) employ qualitative and quantitative approaches to examine how the board structure and process relate to corporate risk pre- and during the recent financial crisis, 2007-2009. The sample of the study includes 141 firms from the largest non-financial firms in the UK. In terms of board structure variables, the study examines board size, CEO/Chairperson duality and the percentage of non-executive directors on the board. The study uses change in financial risk from pre-crisis and crisis period as the main risk measure, where this variable is measured by liquidity risk and financial slack. Overall, the findings of the study provide evidence that board structure and process are determinants of the firms' financial risk. The study documents a negative relationship between the board size and financial risk. Smaller boards with fewer than eight directors have lower financial risk. Further, the study reports an insignificant relationship between non-executive directors and financial risk.

Recently, Minton et al. (2014) examined how the proportion of independent and experienced independent directors on the boards of US bank holding companies is related to the corporate value and risk pre- and during the recent financial crisis. The study covers the period from 2003 to 2008 and considers the crisis period as 2007-2008. Corporate risk taking is measured by total risk and risk-weighted capital ratios. The study documents a positive and significant relationship between experienced independent directors with both market and accounting risk measures before the crisis period. The results suggest that experienced independent directors work in line with shareholders' interests and support more risky decisions. Moreover, large banks with more experienced independent directors suffered more losses during the crisis. These results imply that the boards with more experienced independent directors that took higher risks prior to the crisis are associated with lower corporate performance during the crisis period. It is important to note that these results are driven by large banks in the study sample.

In summary, the evidence on how the board structure is related to the corporate risk during the recent financial crisis has been limited to large firms and uses only two periods, i.e. pre-crisis and crisis period and, more importantly, are inconclusive. This study divides the sample period into three sub-samples: pre-crisis, crisis and post-crisis periods, and then examines the effect of board structure on corporate risk taking during these periods for both financial and non-financial firms.

2.4 Female Directors on Corporate Boards

The previous discussion reviewed the theoretical and the empirical papers on the relationship between board structure and corporate risk taking. In this section, the discussion is around gender diversity on the board of directors, and how it influences corporate risk taking. More specifically, gender diversity refers to the presence of female directors on the board. According to agency theory, the separation between management and ownership leads to agency conflicts (Eisenhardt 1989; Jensen and Meckling 1976). The ability of the board to perform its role effectively depends on its structure and composition (Pearce and Zahra 1992). Many scholars have argued that the presence of female directors affects the board's effectiveness, processes and

consequently the firm's outcomes (Daily et al. 2003; Farrell and Hersch 2005; Kesner 1988).

The main arguments behind supporting the presence of females in leadership positions are related to the importance of diversity. When reviewing the theory, two aspects are revealed in this regard. The first one is related to the effect of females on corporate value creation, and the second is the gender differences in the risk-taking preferences. The next section highlights the importance of female representation on the board of directors. The interdisciplinary nature of this topic makes it possible to rely on different theoretical perspectives. The arguments and the discussion are derived from agency theory, human capital theory, resource dependence theory and social psychology.

2.4.1 Importance of Gender Diversity

It is well documented in the literature that boards with higher female representation have a positive influence on group outcomes (Adler 2001; Campbell and Mínguez-Vera 2008; Carter et al. 2003; Martín-Ugedo and Minguez-Vera 2014). This positive effect comes from the fact that females are able to add value in the workplace (Lucas-Pérez et al. 2014). Boards with more female directors can gain from the benefits of diversity (Carter et al. 2003). Therefore, it is not only the moral and ethical issues or the social justice that are relevant; there are many economic reasons to predict this positive association. Theoretically, several arguments from several theories support the positive link between gender diversity and corporate value.

According to agency theory, boards that are more diverse are more able to perform effectively. Fama and Jensen (1983b, p.311) describe the board of directors as "*The common apex of the decision control systems*". The board of directors validates all the strategic and critical decisions of the firm (Lipton and Lorsch 1992). In addition, the monitoring role of the board is essential to protect the shareholders' rights and limit the managerial opportunistic behaviour (Fama and Jensen 1983b). Within the agency context, for an effective monitoring and decision-making process the board should be independent. Agency theory assumes that the independent directors will not collude with management against the shareholders' interests. Fama (1980)

argues that independent directors have incentives to perform effectively in order to build their reputation in the market as expert monitors.

In line with these arguments, Carter et al. (2003) argue that boards with more diversity increase board independence. This means that more female directors on the board may lead to better monitoring and controlling of management behaviour. The authors explain that when the board members have different gender, ethnicity or cultural background they raise questions and issues in a different way from members with a homogenous structure. It is therefore expected that more diverse boards are more activist and as a result their independence function is enhanced. Consistent with Carter et al. (2003) arguments, Adams and Ferreira (2009, p. 292) support the notion that female directors enhance the board independence as they state *"because they do not belong to the 'old boys club', female directors could more closely correspond to the concept of the independent director emphasized in theory"*.

Human capital theory indicates how an individual's skills, education, and experience improve his/her cognitive and productive abilities and the firm can benefit from these human resources (Becker 1964). There is a widespread view that women lack the required qualifications for leadership positions (Burke 2000; Lucas-Pérez et al. 2014). However, the empirical evidence shows that women are as qualified as men, and it is expected that having more female directors will positively affect the board effectiveness because of their unique diverse human capital characteristics (Carter et al. 2010; Lucas-Pérez et al. 2014; Terjesen et al. 2009). That is, female directors could offer different views and perspectives compared to male directors (Daily et al. 2003; Hillman et al. 2002; Mateos de Cabo et al. 2012). Thus, the presence of female directors can provide the heterogeneity necessary to the board, which in turn increases creativity and innovation and improves the decision-making process (Forbes and Milliken 1999; Robinson and Dechant 1997) .

Human capital theory provides evidence that women might outperform their male counterparts in certain tasks. For example, the board of directors' roles mainly relate to the monitoring & control functions and advice & counsel functions. These roles could be categorised in different ways. One of these categorisations differentiates between financial and strategic control (Loden 1985; Nielsen and Huse 2010a). In

general, financial control is considered short-term and quantitatively oriented while strategic control is long-term and qualitatively oriented. Within this context, Loden (1985) indicates that women are qualitatively oriented. Therefore, it is expected that female directors show superior performance in tasks related to strategic control.

Carter et al. (2010) note that, although the human capital theory predicts that a gender-diverse board may gain from the unique diverse human capital of its members, the contingency theory proposes that the net effect of gender diversity on boards depends on other internal and external factors. Other factors such as firm age, size, business cycle and the regulations within the business environment could also matter. In other words, the effectiveness of such corporate governance practices (e.g. increased board diversity) depends on the interdependencies between the firm and other factors in the internal and external environment (Aguilera et al. 2008).

Resource dependence theory views firms in an open system where there is a need to exchange and acquire resources to survive (Pfeffer and Salancik 1978). The board of directors is the link that creates a dependency between the firm and external units (Carter et al. 2010). In this regard, greater board diversity leads to better access to other networks and contacts with other firms. These networks facilitate access to capital and serve as a channel for communicating and exchanging information with other firms (Preffer and Salancik 1978). In addition, diverse boards improve the firm image in the market, because diversity is viewed as a positive signal that may attract talented and qualified members outside the traditional method of recruitment (Nina et al. 2006; Rose 2007).

Greater equality in terms of more female representation on the board is also useful in reflecting the diverse demographic features of the firm's stakeholder group such as customer, employees, etc. (Mateos de Cabo et al. 2012). Greater diversity also leads to the ability to better understand and penetrate markets. Given that the markets are diverse, diverse boards will be more able to understand and meet the needs of the market (Robinson and Dechant 1997). Carter et al. (2010, p.398) state that "*Resource dependence theory provides the basis for some of the most convincing theoretical arguments for a business case for board diversity*". The authors indicate

that boards that include members with a unique set of information enhance the pool of information and positively improve the decision-making process.

Social Psychology Theory offers another theoretical perspective on group diversity. Theories in the social groups such as social categorisation (Tajfel 1981) and social identification (Turner 1982) predict a negative effect of diversity on firm value. These theories tend to explain how individuals split group members into in-groups (individuals similar to themselves) and out-groups (individuals dissimilar to themselves) where in-groups are considered more favourably (Nielsen and Huse 2010b). Kanter (1977) argues that in-group members usually look for trust and thus any members out of these groups may be considered as a threat. According to these theories, members who have majority status might exert a disproportionate amount of influence in group decisions (Westphal and Milton 2000). This means that female influence exerted in male-dominated boards may be weak. In addition, corporate boards usually include only one or a few females. This minority is usually marginalised when participating in a large group (Kanter 1977). The low representation of female directors may be viewed as token (Kanter 1977). In most cases, tokenism might limit the female influence on decisions and this may lead to females having an insignificant effect on a firm's value creation as well (Adams and Ferreira 2009). Moreover, this phenomenon – tokenism – is perceived negatively as it results in lower influence, isolation and self-doubt (Lucas-Pérez et al. 2014).

Other researchers within the social psychology context suggest that gender diversity may positively affect the group outcomes. Westphal and Milton (2000) argue that the presence of such minorities in the group enhances divergent thinking, which produces higher-quality decisions. This heterogeneity positively brings different perspectives, innovation, and creative ways to problem solving and the decision-making process (Daily et al. 2003; Forbes and Milliken 1999; Hillman et al. 2002). Kim et al. (2009) argue that diversity on boards positively affects and improves the breadth and speed of top management team strategic action. The outcome of social psychology theory predicts that the effect of diversity in groups could impact either positively or negatively on firms' value.

In summary, the previous discussion highlights the importance of gender diversity on board effectiveness. There is evidence that female directors are competent, skilled, and creative, and have external networks and the required human capital for high leadership positions. Several empirical papers support these theoretical predictions. For example, Adler (2001) studies the correlation between promoting females to executive positions and firm profitability. The study measures profitability as a percentage of revenue, assets and equity. For 215 Fortune US 500 firms over 19 years from 1980 to 1998, the results indicate that firms with higher female promotion records have higher profitability. Adler (2001) explains this positive association by the ability of firms with more females to attract talented and qualified candidates. Those qualified candidates with different backgrounds and perspectives lead to superior decisions that are translated into high profitability.

Erhardt et al. (2003) provide similar evidence on this positive relationship. The study examines how demographic diversity on boards of directors affects corporate financial performance. The study was conducted in the US using 127 companies over the period 1993-1998. Their results show a positive influence of female directors on firm value measured by return on assets and return on investment. Consistent with these findings, Campbell and Minguez-Vera (2010) document positive evidence on the appointment of new females on Spanish boards. The authors find that between 1995 and 2000 there were 47 female board appointments. The study conducts an event study to examine the stock market reaction to these appointments. The results indicate that the market positively reacted to the appointment of female directors, which is expressed in higher stock prices. This implies that investors in the market believe that women are able to add value to the firm. This positive link between female directors and corporate value has also gained support in recent empirical papers by Anderson et al. (2011), Joecks et al. (2013) and Palvia et al. (2014).

However, some empirical papers have found a negative or insignificant relationship between female on the boards and firm value (e.g., Adams and Ferreira 2009; Ahern and Dittmar 2012; Carter et al. 2010; Chapple and Humphrey 2014; Rose 2007). One interesting and important paper was provided by Adams and Ferreira (2009). In this study, the sample includes an unbalanced panel of 1,939 US firms. Using the

fixed effect method, the authors provide evidence that female behaviour in the boardroom is different from that of their male counterparts. The findings reveal that female directors have more attendance at meetings, and are more likely to be assigned to monitoring roles such as participating in audit, nominating and governance committees. Moreover, the study reports that boards with more female directors positively affect corporate governance. For example, the study finds that the sensitivity of CEO turnover increases with more female presence on the board. However, Adams and Ferreira (2009) indicate that the effect of female directors on firm value is negative. The authors explain the negative finding as female directors exert too much monitoring which in turn negatively affects firm value.

Other papers explain the negative or insignificant effect as more diverse boards suffer from communication and coordination problems which in turn result in a lower and less effective decision-making process (Forbes and Milliken 1999). In this regard, Earley and Mosakowski (2000) suggest that homogeneity between members leads to better communication as most of them share similar views. Campbell and Mínguez-Vera (2008) agree that gender diversity provides more views and brainstorming but the decision-making process may become less effective and require more time. Milliken and Martins (1996) point out that more dissatisfaction and higher turnover ratio is found in more diverse boards. The next section discusses how female directors behave under risk, given the large debate in the literature regarding the risk differences between male and female.

2.4.2 Female Directors and Corporate Risk Taking

The board of directors performs more effectively if it includes qualified directors with high education, broad views and excellent experience (Carter et al. 2010). Therefore, it is very important to select those directors based on qualifications, talents and skills (Lipton and Lorsch 1992; Pearce and Zahra 1992). This emphasis on the nomination and selection process for board members is related to the importance of board roles (Adams and Funk 2012). The board of directors is responsible for most of the firm's strategic decisions and the application of strong governance practices. However, the environment where most of the managerial decisions take place is described as uncertain. Thus, the decision-making process needs to link the expected positive gain and negative loss for each course of action

(Johnson and Powell 1994). In other words, the directors' decision-making process is related somehow to the risk taking (Johnson and Powell 1994). Therefore, the investment choices, which are determinants of the success of the firm, depend on the risk attitude of the directors (Schubert 2006).

A well-known stereotype states that women are more risk averse than men (Eckel and Grossman 2008; Gustafsod 1998; Selim and McNamee 1999). This widespread stereotype may explain the low representation of female directors on corporate boards since these high leadership positions require risk taking (Croson and Gneezy 2009). This perception that women tend to choose less risky decisions leads to statistical discrimination against them (Johnson and Powell 1994; Schubert 2006; Schubert et al. 1999). Women may be excluded from managerial roles and only offered jobs that are considered low in risk, which might explain the gender gap in wages and career choice (Johnson and Powell 1994). In addition, this issue may result in what is called the "glass ceiling"; that is, female directors' promotion to higher leadership positions is limited (Adams and Funk 2012). The differential in the perception of risk taking between men and women has important economic implications for both of them. As discussed above, it affects their appointment opportunities and their economic success (Johnson and Powell 1994). Therefore, it is important to examine to what extent this stereotype is correct, especially for professional women, i.e. those who already are in high leadership positions.

A large part of the literature in psychology and sociology provides evidence on gender differences under risk. These studies document that women perceive risk differently than men. These differences are found in different behaviours such as alcohol and illicit drug use (Spigner et al. 1993); and technology, industrial hazards, and environmental degradation (Cutter et al. 1992; McStay and Dunlap 1983; Stallen and Tomas 1988) among others. Full reviews in this field are provided by Arch (1993) and Byrnes et al. (1999). These studies compare the propensities of risk taking between male and females in various settings, focusing on the sociological and psychological aspects. The majority of the experimental results show that women strongly avoid risk. Arch (1993) points out that the difference in risk taking results because males view risk as "*a challenge*" while females view risk as "*threats*".

While the psychology and sociology studies provide consensus that female are more risk averse, the results from the economic literature are mixed. The economic literature generally tests gender differences towards financial risk (Croson and Gneezy 2009). Eckel and Grossman (2008) in their review compare the findings from abstract gamble experiments, contextual experiments and field studies. The findings of field studies and abstract gamble experiments show that, in general, women tend to be more risk averse than men (Hartog et al. 2002; Holt and Laury 2002; Jianakoplos and Bernasek 1998; Johnson and Powell 1994; Schubert et al. 1999).

Sunden and Surette (1998) study gender differences in the allocation of asset plans. The study reports that gender and marital status do matter when individuals make their choices in asset allocation. After controlling for several demographic and financial characteristics, married participants were shown to be more risk averse than singles. In addition, when comparing between single participants, women tend to be more risk averse. Consistent with these results, Jianakoplos and Bernasek (1998) find that single women invest less in risky assets. The study presents this result after controlling for different factors such as age, race and the number of children. The authors explain that women tend to have lower wealth because of their risk-aversion behaviour. Bernasek and Shwiff (2001) claim that the results provided by Jianakoplos and Bernasek (1998) and Sunden and Surette (1998) did not indicate who is responsible for taking the investment choice in the married couples. The study reports that women are more risk averse even after using a survey to collect more information on the decision-making process for the married couple participants.

However, the contextual environment experiments offer mixed results regarding the gender differences under risk (Gysler et al. 2002; Kruse and Thompson 2003). For example, Holt and Laury (2002) in their lab experiment show that, when the size of real incentive is large, all the participants (men and women) have a similar risk-aversion attitude. The authors add that women tend to be more conservative in low pay-off decisions. Eckel and Grossman (2008) note that the results from both lab and experimental studies do not consider many variables that may affect their results, such as education and wealth factors among others. In addition, these studies

differ in many aspects such as gamble structure, potential pay-off, etc., that makes comparing the findings a difficult task. More importantly, Adams and Funk (2012, p.219) say that the samples of these studies tend to include workers, students and participants from the general population. Therefore, it is important to understand if these differences hold for females in high leadership positions or not.

One important question could arise here: why do men and women behave differently under risk? The academic literature provides several reasons that may explain these differences. One of these explanations relies on the biological and evolutionary theories. Olsen and Cox (2001) indicate that women tend to be more risk averse because of their role as a mother and care provider. This conservative behaviour is "*adaptionist in that it increased the chances of survival for the human species*" (Olsen and Cox 2001, p. 30). This unique role of the woman as child bearer physiologically led women to exhibit more worry and concern towards others (Gustafsod 1998). Another biological difference is presented by Zuckerman (1994), who indicates that the enzyme monoamine oxidase is higher in women than men. Harlow and Brown (1990) argue that a higher level of monoamine oxidase is associated with more risk-averse behaviour. Therefore, women tend to be less sensation-seeking and more conservative in vague circumstances (Olsen and Cox 2001). Sapienza et al. (2009) also provide evidence that testosterone level is lower in women than men. The authors find that a higher level of this hormone, which is responsible for risk-taking behaviour in the human body, leads to lower levels of risk aversion.

Another reason that might explain gender differences under risk comes from social role and personality characteristics. The earlier work of Slovic (1966) indicates that gender differences under risk start from early ages. The author indicates that social and peer pressure make these differences develop and become more apparent. Lenney (1977) argues that in achievement situations women tend to be less overconfident than men. This gender difference has been documented in several studies across different tasks and situations (Barber and Odean 2001; Beyer and Bowden 1997; Deaux and Emswiller 1974; Lundeberg et al. 1994). Beyer and Bowden (1997) and Deaux and Emswiller (1974) argue that women tend to highly underestimate their abilities in tasks that are described as being *masculine*. Lenney

(1977) reports that self-confidence depends on the availability of performance feedback. According to this, women have lower self-confidence when the feedback is ambiguous and not clear. The author indicates that gender differences in self-confidence disappear when women are informed and have better feedback on their performance.

Furthermore, the literature documents other reasons that may explain the observed gender differences in risk taking. These factors may affect gender behaviour either directly or in an indirect way. For example, women tend to be less educated, have lower income and wealth, and be more emotional (Gustafsod 1998; Loewenstein et al. 2001; Meehan and Overton 1986; Prince 1993; Slovic 1993). These factors might explain their conservative behaviour and their tendency towards more risk aversion.

Despite the large body of literature that documents women as more risk averse, many scholars argue that this may hold only for women in the general population. In other words, gender differences under risk disappear for professional women in high leadership positions (Atkinson et al. 2003; Croson and Gneezy 2009; Gysler et al. 2002; Johnson and Powell 1994; Levin et al. 1988; Masters and Meier 1988; Schubert 2006; Schubert et al. 1999). The reasons behind the male/female similarity in the risk-taking behaviour could be attributed to the selection and experience hypothesis. Croson and Gneezy (2009) argue that women who select these managerial jobs that require risk taking are expected to behave as men. In addition, Adams and Funk (2012, p.220) state that *"women in a predominantly male environment may adapt their behavior so that gender differences disappear"*. Further, women who have more experience and better training became more familiar with the decision-making process and are expected to be more risk enamoured (Croson and Gneezy 2009; Johnson and Powell 1994; Levin et al. 1988; Schubert et al. 1999).

These arguments are empirically supported by, for example Johnson and Powell (1994), who study the differences between males and females in the quality of their decision making. The study constructs two samples: the first one includes a random "non-managerial" sample mainly of customers from UK betting shops. Neither males nor females in this group have any management education skills. The second

group includes students in the final year of their business studies courses. In this "managerial" group, both males and females are already potential managers. The results show that in the first group women tend to be more risk averse. However, no differences were observed in the second group between male and female managers. These results support the notion that only women in the general population behave in a more risk-averse manner; this is not the case for trained and professional women. The authors argue that when females are familiar with managerial decisions, i.e. have the education required, no differences are expected between male and female risk behaviour. The authors conclude that both educated males and females have a similar effect on the firm's decision making.

Atkinson et al. (2003) provide additional consistent evidence in support of the above arguments. The study examines the differences between male and female performance and investment behaviour in US fixed-income mutual funds for the year 2000. Using the OLS technique, the findings indicate that both male and female managers behave similarly in terms of risk and performance. The authors attribute these finding to the investment experience, knowledge and wealth constraints.

Adams and Funk (2012) examine the differences between males and females in core values and risk attitudes at director level. The study develops a survey that was directed to all the board members and CEOs in the public and private Swedish companies in the year 2005. This survey is designed to measure the core values and the level of risk aversion for directors on boards. In the first place, the study documents that those boards with more diversity in terms of gender behave in a different way to homogenous boards. The authors indicate that this different behaviour results because males and females on the boards have different priorities. In addition, female directors in the sample differ from their male counterpart. More importantly, those female directors are even different from females in general populations. The authors suggest that these differences could be attributed mainly to the career choice costs. Accordingly, the study finds that female directors are associated with more risk taking. This finding has an important implication as it breaks the widespread belief that females are more risk averse. The findings of the study are robust after controlling for many observable factors such as age, family status, education and experience.

Consistent with Adams and Funk (2012), recent evidence from Germany in a study by Berger et al. (2014) examined all the executive directors in the German banks during the period 1994-2010. The focus of this study was on how the age, gender and education of board executives affect bank risk taking. The study employs the difference-in-difference estimation method. In this study, this method is applied to two groups. The first one is the treatment group, which includes boards' which experience change in age, gender, and education, while the second group is the control group, where the boards for these banks do not have changes in age, gender and education during the study period. However, one noticeable issue in the study sample is that it includes executive directors (insiders) while the non-executives (independent directors) were excluded. The study documents a positive relationship between female directors on the board and the two risks measures, namely the ratio of risk-weighted assets to total assets and the logarithm Herfindahl Hirschman index. However, the study indicates that the statistical and economic significance of the female effect is slightly weak.

However, other papers report a negative relationship between female directors and corporate risk taking. Adams and Ferreira (2004) investigate how gender diversity in 1462 US publicly traded firms for the year 1998 is related to corporate risk taking. The study measures corporate risk by the standard deviation in the monthly stock return. Using the OLS regression method, they provide evidence that females on corporate board and directors' compensations are negatively related to the corporate outcomes. According to Adams and Ferreira (2004) results, firms with higher risk have fewer female directors on their boards. The authors infer that this negative correlation could be explained as female directors are more risk averse.

Beckmann and Menkhoff (2008) employ a survey that covers 649 fund managers in four countries, namely the US, Germany, Italy and Thailand. The aim of the study was to show how expert male and female fund managers affect decision making. The study builds on the documented gender differences under risk and tests this for professional financial managers. The findings of the survey reveal that female managers are more risk averse than their male counterpart. In addition, the female fund managers in this study also appear to avoid competitive situations. However, the study argues that, in term of less overconfidence, the results do not support this

hypothesis. In the four countries, female fund managers are not less overconfident, and this result is robust using three measures of overconfidence, i.e. overoptimistic self-assessment, illusion of control and miscalibration (Beckmann and Menkhoff 2008, p.4).

Elsaid and Ursel (2011) examine 679 CEO successions in North American firms between 1992 and 2005. In particular, the study investigates how the newly appointed CEO females affect corporate risk. The sample of this study is restricted to large firms only. Corporate risk taking is measured using three proxies; that is, financial leverage, R&D expenses and cash holdings as a percentage from total assets. Using a two-stage least squares regression, the study finds that change in CEO from male to female lowers corporate risk taking. Moreover, when the board has a female CEO, the percentage of females on the board increases.

Barua et al. (2010) examine the relationship between chief financial officer (CFO) and accruals quality. The sample of the study covers 1222 US firms in 2004 and 1559 in 2005. The study documents that the total and current abnormal accruals are lower for firms with a female chief financial officer. Moreover, female CFOs have less error in their accrual estimation. The findings of this study reveal that female CFOs are more cautious and more conservative in several business and finance settings. It is worth noting that the sample only includes large US firms, which may create generalisability concerns. Further, the accruals models employed in the study, as the authors indicate, usually suffer from measurement errors.

Mateos de Cabo et al. (2012) provide evidence on female directors using 612 international European banks across 20 countries. The data of this study was only obtained for the year 2006. Using Poisson regression, the dependent variable considered the number of women on the board. The study documents three important findings. First, having more female directors on the board is associated with lower bank risk measured by standard deviation of the ROAA and equity-on-total assets ratio. The first result implies that female directors are more risk averse. Second, the study documents a positive relationship between the percentage of female directors on corporate board and board size. This implies that larger boards

have more female directors. Finally, the study indicates that banks that adopt a growth policy have more females on their boards.

Lenard et al. (2014) construct a sample from US non-financial firms which includes 5,754 firm-year observations. The study investigates the effect of female directors on variability of stock market return over the period 2007-2011. The study uses two measures for female diversity on the board: the percentage of female directors on the board and a dummy variable equal to one if the board has at least one female and zero otherwise. The findings document a negative effect of female directors on corporate risk taking.

In the UK, the empirical evidence on how the female directors are related to the firms' outcomes is very limited. Most of the existing papers are exploratory in nature, and are typically descriptive rather than identifying a direct link with firms' outcomes (Brammer et al. 2009; Grosvold et al. 2007; Singh and Vinnicombe 2004; Martin et al. 2008). In general, these papers find a higher ratio of female directors in retailing, banking, the media and utilities sectors. In contrast, resources, engineering and business services sectors are dominated by male directors.

Recently, Gregory-Smith et al. (2014) have provided important evidence on female directors' appointment, remuneration and value creation. The study covers the UK listed companies on the FTSE 350 over the period 1996-2011. The study documents a bias in the appointment of female directors especially as non-executive directors. The study finds a low appointment rate for female directors and their appointments are highly dependent on whether a female director has left the board in the recent period. With respect to the gender pay gap, the study reports mixed findings and an unexplained underpayment of female non-executives.

More importantly, the study documents an insignificant relationship between female directors and corporate performance measured by: shareholder return, return on assets, return on equity and Tobin's Q. The authors argue that the absences of a significant effect on corporate outcomes does not undermine the calls for increasing gender diversity on the board of directors since the presence of female directors should be considered as a moral issue: it "*is inherently valuable in and of itself does*

not require justification by citing performance effects" (Gregory-Smith et al. 2014, p.125).

To my knowledge, no study in the UK has linked the presence of female directors on the board of directors with idiosyncratic risk. However, it may be worth noting that one piece of evidence is provided by Dowling and Aribi (2013) who examine the link between the proportion of female directors and firm's acquisitiveness level. The study covers the largest UK companies on the FTSE 100 over the period 2000-2011. The findings document a negative relationship between the female directors on the board and the acquisitiveness of the firm. The authors explain this negative effect from the psychological and decision-making perspectives and argue that females are less overconfident.

The review of the empirical papers indicates that investigating the effect of females in top leadership positions is a relatively new topic and this explains the limited number of empirical papers in this regard. In addition, few papers examine the impact of female directors on corporate boards (Adams and Ferreira 2004; Adams and Funk 2012; Berger et al. 2014; Elsaid and Ursel 2011; Lenard et al. 2014), while the rest of the papers focus on females in lower managerial positions (Atkinson et al. 2003; Beckmann and Menkhoff 2008). The findings are mixed and inconclusive, which highlights the need for more work on this topic. Further, all the mentioned studies are conducted in the US, which implies the need for more investigation using a sample from the UK corporate boards. To my knowledge, this is the first study in the UK that examines the effect of female directors on idiosyncratic risk in both the financial and the non-financial firms. Accordingly, this study aims to extend this literature and provide evidence from the UK public listed firms. The sample of this study is more comprehensive as it includes all the small and large firms listed in the FTSE All-Share Index. This is could be an important issue since the financial sector has different features and characteristics, as indicated above.

2.5 Summary

The first part of this chapter has reviewed the theoretical and empirical work on the board structure-risk-taking relationship. In this regard, the review relies mainly on agency theory. The focus of this theory is on the agency problems that arise between the contractual parties, i.e. the agent and the principal, due to the divergence of interest. Agency theory is the most popular theoretical background and receives much attention from researchers in the corporate governance area. Further, agency theory offers a powerful tool for providing an insight into suggested solutions to the conflicts arising in the principal-agent relationship. Accordingly, this theory is taken as the main theoretical approach in studying the board structure-risk-taking relationship.

The empirical works on the board structure-risk-taking relationship have also been reviewed. The literature indicates that the board size, independence and CEO/Chairperson duality are relevant to corporate risk taking. However, the results are mixed and inconclusive. Likewise, the review examines the empirical papers on the board structure-risk-taking relationship during the recent financial crisis. The relevance of discussing this economic event is that the weakness of governance mechanisms, particularly the board of directors, has been cited as a cause of the crisis.

The second part of this chapter has reviewed the theoretical and empirical literature on female directors and corporate risk taking. The review in this regard relies on different theories such as agency theory, human capital theory, resource dependence theory and social psychology theory since this topic is studied in different fields. The academic literature provides support for the importance and the value that female directors can add to the firm. Further, female representation on the board is described as a good governance practise. Despite these advantages of gender diversity, the widespread belief that women are more risk averse limits the number of females in high leadership positions.

The empirical review on the female directors-risk-taking relationship has provided mixed results. However, the empirical evidence indicates that the risk-aversion

behaviour may hold for females in the general populations. Nevertheless, gender differences in risk-taking preferences disappear for females in high leadership positions. The reasons may be related to the experience, good training and other features related to such business environments.

In conclusion, this study aims to examine the effect of board structure and the presence of female directors on corporate risk taking. The study aims to mitigate the limitations and fill the gaps identified in the previous review. This study employs a panel data set for the 10-year period from 2003 to 2012. Further, the sample of the study includes both financial and non-financial firms listed in the FTSE All-Share Index. In terms of methodology, this study follows Wintoki et al. (2012) and uses a dynamic panel estimator to control for endogeneity in the model. The next chapter explains the research methodology and the data collection process for this study.

Table 2.1 Summary of Key Studies on the Relationship between Board structure, Female Directors and Corporate Risk Taking:

Summary of Key Studies on the Relationship between Board Structure and Corporate Risk Taking					
Study	Sample Characteristics	Dependent Variable(s)	Independent Variable(s)	Estimation Method	Main Findings
Adams and Ferreira (2005)	***Non-Financial Sector only*** 336 U.S firms from 1992 to 1999	1. Standard deviation of monthly stock return. 2. Standard deviation of ROA 3. Standard deviation of Tobin's Q	CEO power as a dummy if 1. CEO founder 2. CEO also chairperson 3. CEO only insider	Panel data across firm and within firm variability's	1. A positive relationship between CEO power and stock return variability. 2. A positive and significant relationship only between CEO founder and ROA& Q.
Cheng (2008)	***Non-Financial Sector only*** 1252 U.S non-financial firms over 1996-2004	1.Standard deviation of monthly stock return 2.Standard deviation of ROA 3. Standard deviation Tobin's Q 4. Standard deviation Market-adjusted monthly stock return 5. Standard deviation Industry adjusted ROA 6. Standard deviation Industry adjusted ROA	1.Board size 2.Board Independence 3.Duality	Within-firm, over-time variability	1. A negative relationship between board size and all risk measures. 2. Insignificant relationship between board independence and all risk measures 3. Insignificant relationship between duality and all risk measures.
Kim and Buchanan (2008)	***Non-Financial Sector only*** U.S Fortune 1000 firms for the year2002	Income stream risk	1.CEO duality 2.CEO ownership 3.Ownership concentration	Hierarchical regression	1.A negative relationship between CEO duality and firm risk 2.Insignificance relationship between ownership concentration and firm risk 3. Insignificance relationship between CEO ownership and firm risk.
Brick and Chidambaran (2008)	***Non-Financial Sector only*** 4,162 observations from U.S over the period 1996 to 2003	1.The number of independent directors 2.The percentage of independent directors	Volatility of stock returns	OLS two-stage least squares	1.A negative relationship between board independence & monitoring and firm risk in absence of external regulation
Pathan (2009)		1.Total risk	1.Board size	GLS	1.A negative & significant relation between board

	Financial/Banks only 212 large US bank holding companies over 1997–2004	2. Systematic risk 3. Idiosyncratic risk 4.Asset return risk 5. Insolvency risk	2.Board Independence 3.Duality 4.Shareholders'restrictive right	(Generalized least square)	size all risk measures 2.A negative & significant relationship between independence and all risk measures except Z score insignificant 3.A negative and significant between duality and Total risk, Idiosyncratic risk & Asset return risk but negative & insignificant for Systematic risk & Insolvency risk
Chen (2011)	***Non-Financial Sector only*** Non-financial firms of China's capital markets over 2002 to 2008.	1.Standard deviation of corporate profitability EBIT/Assets	1.Board size 2.Duality 3.Board independence 4. Ownership of the board shareholders	Cross sectional analysis	1.A negative relationship between board size and risk taking 2. A negative relationship between board ownership and risk taking 3. Insignificant relationship between duality and firm risk. 4. Insignificant relationship between board independence and risk taking.
Houssem and Ines Ghazouani Ben (2011)	***Financial/Banks ONLY*** 11 large Tunisian commercial banks during 1997-2006	1. Z-score	1. Board size 2. Independent directors	Generalized least square (GLS) One step Generalized method of moments (GMM)	1.A negative relationship between board size and corporate risk 2. Insignificant relationship between board independence and corporate risk taking
Wang (2012)	***Non-Financial Sector only*** 1,618 U.S non-financial firms over the period 1992-2004	1. The sensitivity of CEO wealth to stock price. 2. The sensitivity of CEO's wealth to stock return volatility, or Vega. 3. R&D expenditures 4. Leverage 5. Variance of monthly stock returns 6. Cash flow volatility	Board size	Pooled panel regression	1. A negative relationship between board size and Delta, Vega, R&D, Leverage and cash flow volatility.
Nakano and Nguyen (2012)	***Non-Financial Sector only*** 1,324 Japanese firms 2003-2007	1.Standard deviation of ROA 2. Standard deviation of Tobin's Q	1. Board size 2. Board Independence	OLS	1.A negative relationship between board size and corporate risk 2. Insignificant relationship between board independence and corporate risk taking

		3. Standard deviation of stock returns 4. Bankruptcy Risk			
Lewellyn and Muller-Kahle (2012)	***Financial/ subprime lending only*** 74 U.S financial firms specialising in subprime lending over the period 1997 to 2005.	Subprime Lending Specialist: is a dichotomous variable which takes a value of one if the firm specialises in subprime lending	1.Duality 2.Board independence 3.CEO ownership 4. CEO Tenure 5. Outside director tenure 6. CEO prestige	Random effects logistic models	1. A positive relationship between CEO power with the likelihood a firm specializing in subprime lending. 2.A negative relationship between level of ownership and the likelihood of a firm specialising in subprime lending 3. A negative relationship between outside director tenure with the likelihood a firm specialising in subprime lending.
Erkens et. al (2012)	***Financial/Banks, Brokerage and insurance firms*** 296 financial firms from 30 countries 2007-2008 cover	1.Expected default probability 2.Stock return volatility	1. Board independence 2. Institutional ownership	OLS	1.Insignificant relationship between board independence and risk taking 2. A positive relationship between institutional ownership and risk taking.
Tao and Hutchinson (2013)	***Financial/ diversified financials, banks, insurance, real estate companies and real estate investment trusts*** 716 observations from the Australian financial firms over 2006-2008	1.Beta 2.Earnings per share	1. Number of directors on the compensation and risk committee 2. Dummy variable equals 1 when the director serves on both the compensation and the risk committee and 0 otherwise 3.Board size	GLS (Generalized least square)	1.A positive relationship between compensation committee and risk taking 2. A positive relationship between risk taking and performance when the director serves on both the compensation and the risk committee. 3.Insignificant relationship between board size and risk taking
McNulty et.al (2013)	***Non-Financial Sector only*** 141 UK industrial firms over the period 2007-2009	Financial risk measured by change in, cash& equivalents, net cash and financial slack	1.Board Process/Cohesiveness 2. Board Structure	Mixed method questionnaire survey and OLS	1.A negative relationship between board size and financial risk 2. Insignificant relationship between the proportion of non-executive directors and financial risk 3. A negative relationship between the proportion of non-executive directors with high effort norms and financial risk 4. A negative relationship between cognitive conflict level and financial risk
Koerniadi et al. (2014)	***Non-Financial Sector only*** 82industrial firms listed in New Zealand Exchange 2004-2008	Standard deviation of monthly raw returns	1. Board size 2. Board Independence 3. Block holding 4. Directors' share	OLS Fixed Effect	1.A negative relationship between board size and firm specific risk 2. Multiple large shareholders facilitate higher levels of risk-taking by the firm

			ownership 5. Independent directors' share ownership 6. Non-independent directors' remuneration		3. Insignificant relationship between board independence and risk taking
Gonzalez and André (2014)	***Non-Financial Sector only*** 916 firms in the UK over the period 1992-2010	Short-term Beta	1.Board size 2.Independent directors 3. Experience 4. Directors' shareholdings	OLS	1.A positive relationship between board size and short-term Beta 2.A negative relationship between the proportion of non-executive directors and short-term Beta
Minton et.al (2014)	***Financial/Bank holding companies, investment banks and saving & loan*** 119 US financial firms over the period 2003to 2008	1.Total risk 2. real-estate-related activity 3. leverage	1.Independent Directors 2.Independent directors who are classified as financial expert	OLS	1.A positive relationship between independent directors with financial expertise and both risk measures in the pre-crisis period 2. A negative relationship between independent directors with financial expertise and performance during the crisis.
Summary of Key Studies on the Relationship between Female Directors and Corporate Risk Taking					
Adams and Ferreira (2004)	***Non-Financial Sector only*** 1462 US publicly traded firms for the year 1998	Proportion of female directors on corporate boards	Standard deviation in the monthly stock return	OLS	A negative relationship between the proportion of female directors and corporate risk
Elsaid and Ursel (2011)	***Non-Financial Sector only*** 679 CEO successions in US firms	1.Financial leverage 2.R&D expenses 3. Cash holdings as a percentage from total assets.	1. Change in the percentage of females on the board 2.Change in the gender of the CEO	Two-stage least squares	1.A negative relationship between change in CEO from male to female and corporate risk taking 2.A positive relationship between female CEO and the proportion of female directors on board
Adams and Funk (2012)	***All the directors of public and private Swedish firms*** In the year 2005	1.Core values 2.Risk attitudes	Female directors	Questionnaire	A positive relationship between female on corporate boards and firm risk taking
Mateos de Cabo et al. (2012)	***Financial/Banks ONLY*** 612 international European banks across 20 countries for the year 2006	Number of women on the board	1.Standard deviation of the ROAA 2.Equity-on-total assets ratio	Poisson regression	A negative relationship between number of women on the board and both risk measures
Berger et al. (2014)	***Financial/Banks ONLY*** All the German banks over the period 1994-2010	1.Ratio of risk-weighted assets to total assets 2. Logarithm Herfindahl Hirschman index	1.Directors' age 2.Directors' gender 3.Directors' education	Difference-in-Difference	A positive relationship between female directors on the board and the two risks measures
Lenard et al. (2014)	***Non-Financial Sector only*** 5,754 firm-year	Variability of stock market return	1.Percentage of female directors on the board	OLS	A negative effect of female directors on corporate risk taking.

	observations using US firms over the period 2007-2011		2.Dummy variable equal to one if the board has at least one female and zero otherwise		
This Study	***Non-Financial sector*** 589 UK public listed companies ***Financial sector*** 273 UK public listed companies (banks, Insurance, Real estate and Financial services firms). Covers the period from 2003-2012.	1.Total risk 2. Idiosyncratic risk (Firm specific risk) 3. Z-score	1.Board size 2.Board Independence 3.Duality 4. Female Directors	Panel dynamic estimator Two step GMM "System GMM"	1. A negative relationship between board size and firm specific risk in non-financial sector. 2. Insignificant relationship between board size and both risk measures in financial sector. 3. A negative and significant relationship between board independence and firm specific risk in non-financial sector. 4. A negative and significant relationship between board independence and both risk measures in financial sector. 5. A negative and significant relationship between CEO/Chairperson duality and both risk measures in non-financial sector. 6. A negative and significant relationship between CEO/Chairperson duality and firm specific risk in financial sector. 7. A positive and significant relationship between percentage of female directors and firm specific risk in non-financial sector. 8. Insignificant relationship between percentage of female directors and both risk measures in financial sector.

Chapter 3

Research Methodology and Data

3.1 Introduction

The previous chapter provided a comprehensive discussion of the corporate governance literature that is relevant to this research. The agency theory that shapes the base for this study addresses the importance of the board of directors. According to the agency theory, the board of directors is the main internal governance tool that monitors and controls the managerial actions (Fama and Jensen 1983b; Jensen and Meckling 1976). Therefore, the effectiveness of the board of directors may serve in reducing the agency conflicts between the firms' managers and shareholders (John and Senbet 1998). Based on this theoretical background, this chapter explains the research methodology.

The research methodology chapter in this thesis is of utmost importance, as it aims to confirm the robustness of the empirical results. The main objective of this chapter, therefore, is to deliver a clear and solid research method. In the first place, the research philosophy that is adopted in this study is explained and discussed. Further, this chapter addresses in detail the part that is related to the data employed in this study. Particularly, it provides a comprehensive explanation of the data collection process, variables' definitions and measurement. From the econometric point of view, this chapter describes the models' specifications and the estimation methods that will be applied in the empirical chapters.

The rest of this chapter is structured as follows: section 3.2 discusses the research philosophy. Section 3.3 presents the data collection procedures, sources and the main criteria for sample construction. Section 3.4 describes and defines the study variables. This section in particular sheds light on the variable measurement procedures that are consistent with the previous related literature. The descriptive statistics of the study variables in addition to the correlation matrix are provided in sections 3.5 and 3.6 respectively. In section 3.7, the empirical models are presented. Section 3.8 describes the analytical strategies that the study adopts in dealing with different econometric

problems. This section also explains the main estimation method that is used in the data analysis. The final section concludes the whole chapter.

3.2 Research Philosophy

The validity of any research depends mainly on the correct selection and rational order of the steps and procedures used. The selection of each step from the different available options should be justified according to the research's objectives, nature and features. Saunders et al. (2012) describe these procedures as an onion's layers. According to the authors, these layers comprise research philosophy, approach, strategy, time horizon, data collection and analysis methods. In this section, the discussion is around the choice of research philosophy, which is associated with the development of knowledge and the nature of that knowledge (Bryman 2012). However, the rest of the research procedures are presented in the following sections in this chapter.

The choice of which research philosophy is more relevant depends on ontological, epistemological and methodological assumptions of the research. Blaikie (2000, p.8) defines Ontology as "…*claims and assumptions that are made about the nature of social reality, what exists, what it looks like, what units make it up and how these units interact with each other. In short, ontological assumptions are concerned with what we believe constitutes social reality*". Marsh and Stoker (2002) argue that being aware of the research's social, political and economical reality facilitates the selection of ontological position for both the research and the researcher. Two different ontological positions exist that help to determine the ontological perspectives of researchers, namely objectivism and subjectivism (Saunders et al. 2012).

Objectivism is "*an ontological position that asserts that social entities exist in a reality external to, and independent of, social actors concerned with their existence*" (Saunders et al. 2012, p.676). Thus, objective researchers view the nature of reality as external fact, consisting of real and factual aspects and which cannot be influenced, while an opposing ontological position, subjectivism, views the social phenomena as products of social interaction and in a constant state of revision (Bryman 2012). Unlike subjectivism, objectivism see the social phenomena far from and independent of the individual's appreciation (Burrell and Morgan 1979).

The second branch of philosophy, i.e. epistemology, is particularly about what constitutes acceptable knowledge: the nature, method and base of knowledge (Blaikie 2000; Bryman 2012). Blaikie (2000, p.8) defines epistemology as "…*the possible ways of gaining knowledge of social reality, whatever it is understood to be*". Within this context, two epistemological positions fall under the research philosophy, namely positivism and interpretivism (Bryman 2012; Hussey and Hussey 1997; Patton 1990).

Positivism refers to "…*working with an observable social reality and that the end product of such research can be law-like generalisations similar to those produced by the physical and natural scientists*" (Remenyi 1998, p.32). In this regard, the basic objective of theories is to form testable hypotheses, which are tested in order to develop these theories. Accordingly, to avoid replication a solid research method should be employed (Gill and Johnson 2002). Accepting or rejecting the tested hypotheses is expected to add to the development of examined theories (Bryman 2012). Interpretivism, however, views the reality as socially constructed and influenced by the observer (Patton 1990).

With respect to the research approach, Saunders et al. (2012) suggest that two approaches are commonly used, namely deductive and inductive approaches. The deductive approach develops hypotheses based on an existing theory, and then this approach collects and analyses data in order to test these hypotheses; while the inductive approach collects and analyses data first, and then a theory is developed to justify the results of data analysis. In other words, the deductive approach tests existing theories while the inductive one builds or generates theories. Ticehurst and Veal (1999) suggest that positivist researchers typically take the deductive approach in their research. Accordingly, this study employs a deductive approach, since it relies on prior literature on how the board of directors could affect the risk-taking behaviour of the firm. Further, prior works in this area provide a background on this topic, which makes it possible for the researcher to form hypotheses and test existing theories.

The argument in this study relies mainly on agency theory and other perspectives that are considered part of the positive accounting theory (Iskander 2008). Ontologically, this study takes an objective position, i.e. depending on accounting theory in examining phenomena where the reality is objective, independent of and external to observer

influence (Saunders et al. 2012). Relying on objectivist ontological and positivist epistemological positions, this study adopts a hypothetic-deductive method, which is more relevant to this research. In this regard, this study starts with examining relationships between certain variables based on a theoretical background. After that, the study forms a set of hypotheses followed by data collection and analysis. Further, the set of hypotheses are accepted or rejected based on the findings of data analysis. Furthermore, these results are expected to develop the examined selected theory.

Another important step is to determine which research approach is more relevant, i.e. a quantitative or qualitative one. However, selecting the appropriate ontological position facilitates this task, where objectivity is an important pre-set criterion in quantitative approaches and unlike qualitative approaches, which suggest that objectivity is difficult and even not possible to achieve (Iskander 2008). Taken together, the research philosophy of this study relies on an objectivist ontological position, adopting a quantitative research approach that seems more relevant to test research hypotheses. Moreover, the quantitative research approach allows the researcher to be independent from his/her data, which in turn helps to satisfy the positivist epistemological position.

Regarding research method, a review of prior corporate governance literature indicates that three types of research method have been employed. Typically, these methods are questionnaires, interviews, and data base surveys. The dominant method is data base surveys, while few studies employ qualitative research methods. The limited use of qualitative research may be attributed to the difficulties in gathering such data in corporate governance or the objectivity of the research in this area, where it may be considered a difficult task for the researcher to collect and assess data on how internal governance mechanisms support the governance quality (Clarke 2004). Based on this discussion, data base survey is adopted in this study.

Determining the relevant research paradigm is another crucial step. Saunders et al. (2012, p.118) define research paradigm as " … *a way of examining social phenomena from which particular understandings of these phenomena can be gained and explanations attempted*". Further, the research paradigm enables the researcher to offer a clear and rich understanding of his/her research, and is selected according to ontological and epistemological positions adopted (Burrell and Morgan 1979).

According to Burrell and Morgan (1979), four main research paradigms are suggested and can be arranged to match four dimensions, as revealed from the following figure:

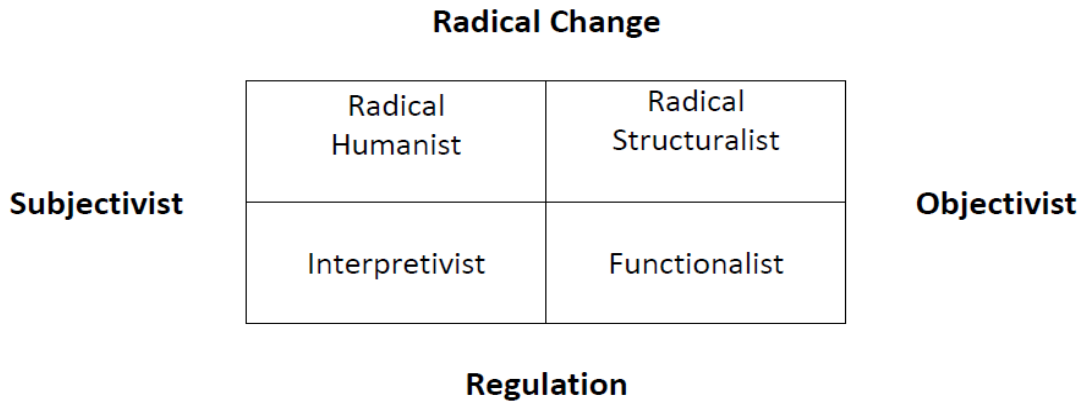

Figure 3.1 Main Paradigms for Social Sciences Analysis. Source: Burrell and Morgan (1979)

Figure 3.1 displays four research paradigms, namely functionalist, interpretive, radical humanist and radical structuralist. As shown from the figure, the main research paradigms are categorised under four philosophical dimensions: subjectivist, objectivist, radical change and regulation. The functionalist paradigm corresponds with the objectivist and regulatory dimensions. According to the functionalist paradigm, rational and reasonable understanding of a problem within an organisation leads to development of a logical solution (Bryman 2012). Further, Burrell and Morgan (1979, p.26) describe this paradigm as "*…problem-oriented in approach, concerned to provide practical solutions to practical problems"*. According to Saunders et al. (2012), and based on the figure and dissection provided above, the ontological position that matches the functionalist paradigm is objectivism. As a result, functionalist seems to be the relevant paradigm to fit with data of this study and the philosophical thinking of the researcher.

To summarise, this empirical study relies on objectivist, ontological and positivist epistemological positions, and thus, a hypothetic-deductive methodology is adopted. This methodology develops a set of hypotheses to be tested based on a selected theoretical background. Furthermore, the relevant research approach to test these

hypotheses is considered a quantitative research approach. This study adopts the survey methodology in data collection, longitudinal/panel data, using secondary data. This summary is also provided in Figure 3.2.

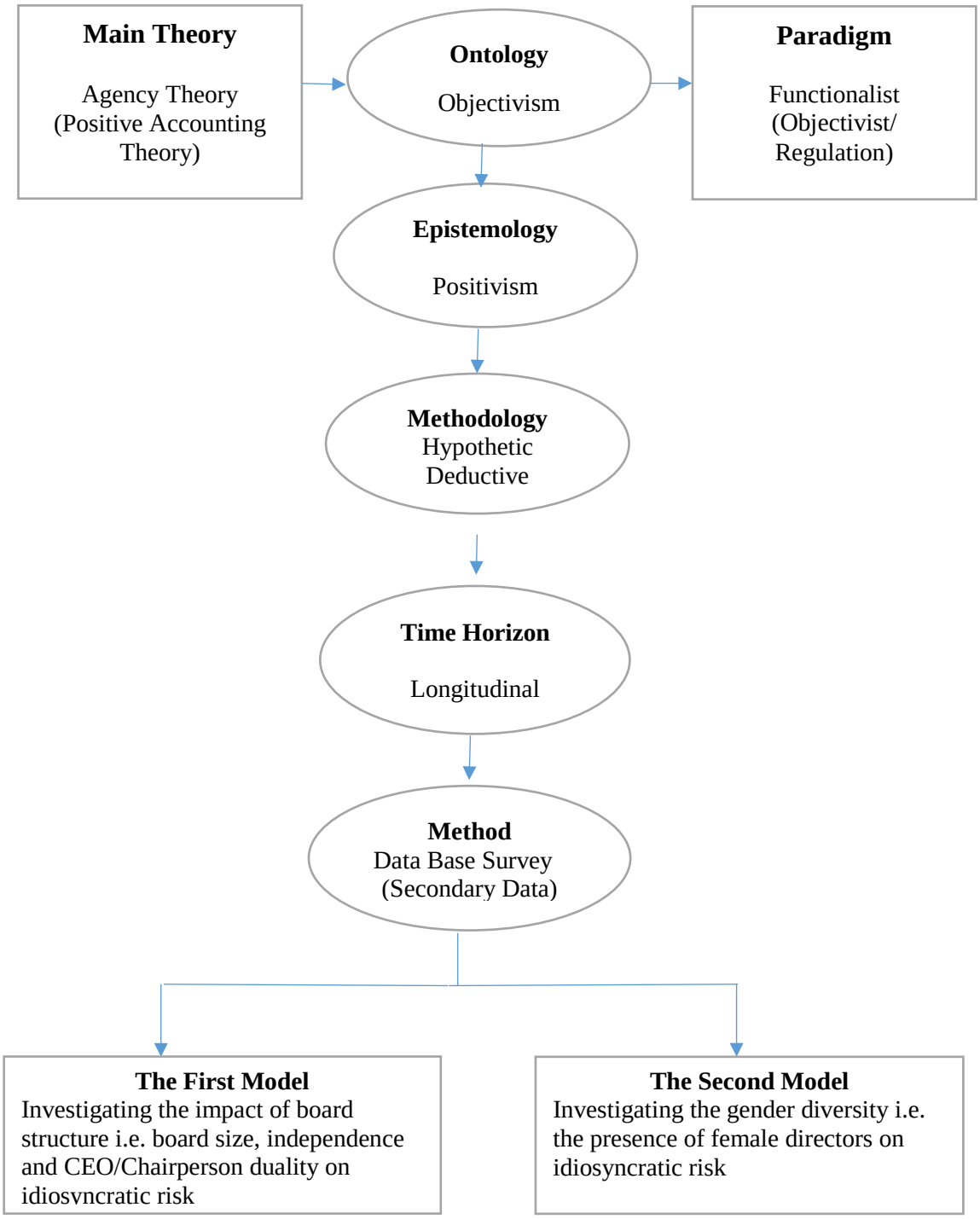

Figure 3.2 Research Philosophy and Models

Source: The idea for the Figure is taken from Iskander (2008) and adjusted by the researcher.

3.3 Data and Sample

This section provides the process of data collection in this study. In addition, it explains the main criteria that are adopted in both the non-financial and financial sector to reach the final sample. The sample of this study is constructed using an unbalanced panel dataset of UK listed companies in the FTSE All-Share Index. This index includes FTSE 100, FTSE 250 and FTSE Small Caps, which represent large, medium and small UK firms respectively. The FTSE All-Share Index is considered to be the broadest in the UK market, accounting for 98% of the UK market capitalisation (FTSE Factsheet 2008).

The coverage of the whole index indicates that the sample of the study is free from possible size bias, since most of the prior studies focused either on large or small firms only. The study covers both financial and non-financial sectors for companies listed in the FTSE All-Share Index. However, the analysis will be performed for each sector independently for comparison purposes. This study covers the period of 2003-2012, during which the recent global financial crisis took place, which is relevant for further understanding of a market event in the current study. Further, in June 2003, a new combined code was introduced and made an important change for board independence requirements. The new combined code 2003, requiring that at least half of the board should be non-executive directors instead of a third, which was the ratio specified in the previous codes. Taking this issue into consideration, this study selects the year 2003 as the beginning of the study period.

3.3.1 Sample for the Non-Financial Sector

The data set for this study includes the UK listed firms in the FTSE All-Share Index on the London Stock Exchange over the period 2003-2012. This period provides up-to-date data. In addition, the study covers both active and dead stocks, i.e. stocks of firms that were de-listed at some point during the sample period; thus, the dataset is free from any possibility of survivorship bias. As mentioned before, the sample includes large, medium and small UK firms and this issue addresses Hermalin and Weisbach (2003) concern regarding size bias which was raised in their paper.

The initial sample contains 1013 firms. However, some observations are lost as a result of the following criteria: first, the study excludes the financial institutions, i.e. banks, insurance companies, real estate and financial service firms in order to analyse them in a separate sample to facilitate the comparison between the two sectors. In addition, it is documented that the risk taking and performance metrics differ between the two sectors as the financial sector operates in a more risky environment (Adams et al. 2005; Akbar et al. 2013; Gonzalez and André 2014; Nguyen 2011). Further, as discussed in the second chapter, the executives of financial institutions have more incentive for excessive risk taking (Andres and Vallelado 2008; Nam 2004; Sepe 2012). Therefore, it is expected that the effect of board structure may be different between the two sectors.

Second, consistent with the related literature and in order to calculate the idiosyncratic risk, each firm should have at least 36 months of consecutive monthly stock market return to be included in the sample (Cheng 2008; Florackis et al. 2011). Missing values in a firm's monthly returns are treated in the same way as in Shumway (2001), in which the average return of the FTSE All-Share Index is used as a substitute. Third, to be able to carry out the dynamic panel System GMM we require that each firm has at least five consecutive years of observations (Florackis and Ozkan 2009a).

Finally, the main source of the governance data is the BoardEx database. This business database covers more than 350,000 business leaders' profiles and includes data for 19 countries. The BoardEx database is used in most of the recent research papers in corporate governance (Erkens et al. 2012; McNulty et al. 2013; Minton et al. 2014) . Accounting data mainly from the World Scope database and the market data were extracted from the DataStream database. For the firm to be included in the sample, it should be available in BoardEx, World Scope and DataStream databases. The final sample includes 589 non-financial firms. Table 3.1 indicates the sample construction process that led to the final sample in the non-financial sector. Table 3.2 indicates the distribution of the sample according to the industry classification.

Table 3.1 Sample Construction for the Non-Financial sector

Initial sample	***1013 firms***
Exclude financial firms	367 firms
Exclude firms with no governance data in BoardEx	30 firms
Exclude firms with no market data	18 firms
Exclude firms with less than five years' consecutives data	9 firms
Final sample for non -financial sector	***589 firms***

Table 3.2 Non-Financial Firms Industry Classification

Industry Classification of Final Sample	***Industry Code***	***Number of Firms***	***Percentage from Final Sample***
Oil & Gas	IN1	37	6.28%
Basic Material	IN2	42	7.13%
Industrials	IN3	176	29.88%
Consumer Goods	IN4	58	9.84%
Health Care	IN5	38	6.45%
Consumer Services	IN6	151	25.63%
Telecommunications	IN7	13	2.20%
Utilities	IN8	18	3%
Technology	IN9	55	9.3%
Total		***589***	***100%***

3.3.2 Sample for the Financial Sector

This study covers the UK financial institutions in the FTSE All-Share Index that are listed on the London Stock Exchange over the period 2003-2012. The UK financial sector includes banks, insurance, real estate, and financial services firms. The classification of this sample is similar to recent studies from the US (Akhigbe and Martin 2008; Erkens et al. 2012; Tao and Hutchinson 2013). The financial sector firms will be analysed separately because they work in a riskier environment compared to other industries (Pathan 2009; Tao and Hutchinson 2013).

Further, in most of the corporate governance research, financial institutions were explicitly excluded (see for example, Adams et al. 2005; Cheng 2008; Nguyen 2011). The higher level of risk in the financial sector makes it difficult to generalise results to other industries. In addition, the financial sector is heavily regulated (Laeven and Levine 2009). More importantly, the analysis of the risk-taking behaviour of the financial sector is considered to be a critical aspect due to its effect on economic growth, business cycle fluctuations, and other sectors in the market as well (Keeley 1990).

Following Erkens et al. (2012), this study does not use any specific bank financial statement items such as loans or deposits or interest because the sample covers the whole financial sector, not just banks. The initial sample starts with 367 financial institutions listed on the London Stock Exchange. Both active and dead financial firms were included to avoid any survivorship bias in the study. The same criteria that apply for the sample of non-financial firms also apply for the financial sector. These criteria lead to a final sample of 276 firms. Table 3.3 indicates the distribution of the sample.

Table 3.3 Sample of Financial Firms Industry Classification

Industry Classification	*Industry Code*	*Number of firms*	*Percentage from final sample*
Banks	IN1	9	3.2%
Insurance companies	IN2	30	10.8%
Financial services	IN3	185	67%
Real estate firms	IN4	52	18.8%
Total		***276***	***100%***

3.4 Description and Measurement of Variables

This section provides the definition and measurement of the variables used in this study. A detailed description for the dependent, independent and control variables is provided. Table 3.4 displays a summary of the variables' names and definitions as well as sources of data.

3.4.1 Measuring Corporate Risk Taking

This study aims to examine the effect of board structure and female directors on corporate risk taking. More specifically, the focus of this study is on idiosyncratic risk, which is also known as firm-specific risk. As noted before, in this study, firm-specific risk and idiosyncratic risk will be used interchangeably. This part of the risk is more likely to be affected by the directors' decisions (Jin 2002). Accordingly, this study employs two market-based measures of corporate risk taking, i.e. total risk and idiosyncratic risk, as the main risk measures. Further, to ensure completeness, this study also employs an accounting risk measure, i.e. Z-score, in the robustness checks. The combination of market and accounting risk measures will provide a more comprehensive view of the firm risk position.

However, selecting market-based risk measures as the main ones in this study comes from the fact that they may provide superior results, since accounting measures suffer from several limitations. For example, most of the accounting ratios depend on the firm's financial statements; these statements record accounting items using historical cost, which may differ from the accurate market values of these assets (Agarwal and Taffler 2008). In addition, these accounting statements are prepared by the firm management, which means they may be subject to manipulation. Hillegeist et al. (2004) argue that the reliability of accounting statement in predicting bankruptcy risk is limited because of management manipulation concerns.

In contrast, market measures are able to reflect more information that is not available in the accounting statements. Agarwal and Taffler (2008) mention some advantages of the market-based measures over the accounting one. For instance, stock prices reflect all the available information especially in efficient markets. In addition, market measures

are far from management manipulation and are not subject to the firm accounting policy. Moreover, these measures are not sample-specific since most of the accounting ratios depend on the sample for their estimates (Agarwal and Taffler 2008). Accordingly, this study uses total risk and idiosyncratic risk as the main market risk measures for both financial and non-financial sectors. The focus will be on idiosyncratic risk, given that idiosyncratic risk is highly affected by the directors' decisions and therefore the structure of the board is expected to matter in this case. In addition, total risk is used because it includes idiosyncratic risk in its components.

Total Risk

Total risk reflects the total volatility in the stock returns. Pathan (2009) argues that total risk is typically observed by regulators and firm executives as it shows the riskiness of assets, liabilities, and off-balance-sheet positions. Moreover, total risk captures the idiosyncratic risk in its components, which is the focus of this study. Following Jin (2002), Baixauli-Soler et al. (2014), Armstrong and Vashishtha (2012) and Vieito and Khan (2012), total risk is measured as the standard deviation of monthly stock return using 60 months' consecutive returns with a minimum of 36 months. Alford and Boatsman (1995) argue that estimating volatility using monthly stock return over a five-year period yields more accurate results.

The firm's monthly stock return is calculated using the return index data-type RI from the DataStream database. According to the DataStream definition, the return index indicates the growth in the theoretical value of the stock for a specified period and, more importantly, the dividends are assumed to be reinvested[6]. Following Stark and Soares (2009), the monthly stock returns are calculated using the following equation:

$$r_{i,t} = RI_{i,t} / RI_{i,t-1} - 1 \quad \ldots\ldots\ldots \quad (3.1)$$

[6] DataStream defines RI as the theoretical growth in value of a shareholding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. The equation to calculate RI is:

$$RI_t = RI_{t-1} * \frac{PI_t}{PI_{t-1}} * \left(1 + \frac{DY_t}{100} * \frac{1}{N}\right)$$

Where: RI_t is return index on day t, RI_{t-1} return index on previous day, PI_t price index on day t, PI_{t-1} price index on previous day, DY_t dividend yield % on day t, and N = number of working days in the year (taken to be 260).

Where $r_{i,t}$ is the monthly return of stock **i** at month **t**, $RI_{i,t}$ is the return index for stock **i** in month t, and $RI_{i,t-1}$ is the return index for stock **i** in the previous month.

Idiosyncratic Risk

The second proxy of risk taking refers to the idiosyncratic risk or the so-called firm-specific risk. This risk component captures the volatility that is unique to an individual firm. "*By definition, idiosyncratic risk is independent of the common movement of the market*" (Fu 2009, p. 26). The importance of examining idiosyncratic risk is related to the following points. In the first place, idiosyncratic risk is directly affected by the directors' decisions (Jin 2002); this is why it is the focus of this study. Second, the price of the stock option depends on the total variability of the underlying stock, which mainly relies on the idiosyncratic risk as it shapes the largest component (Gregory et al. 2013). Third, Gregory et al. (2013, p. 359) indicate that managers of non-financial firms pay special attention when dealing with idiosyncratic risk as it captures their equity price risk. Finally, the amount of idiosyncratic risk may affect the information carried in the stock's return (Gregory et al. 2013; Durnev et al. 2003).

Therefore, it is clear that idiosyncratic risk is a very important aspect for both the investors and the firm's managers. The recent empirical literature indicates the failure of the CAPM model to explain the cross-sectional variation in the stock return; even though it is a well-accepted model in the asset pricing literature (Fama and French 1992, 1993). To calculate the idiosyncratic risk this study uses the three-factor Fama-French model (1993). Following Jin (2002), Bali and Cakici (2008) and Armstrong and Vashishtha (2012), idiosyncratic risk is measured as the standard deviation of the residuals from the Fama and French model. According to equation (3.2), idiosyncratic risk is measured as the standard deviation of the residuals, i.e. idiosyncratic risk (Fama-French) $=\sqrt{Var(\varepsilon it)}$. The study used 60 months' consecutive returns with a minimum of 36 months to calculate the residuals; this criterion is in line with Cheng (2008), Nguyen (2011) and Florackis et al. (2011).

$$r_{it} - Rf_t = \alpha_1 + \beta\,(Rm_t - Rf_t) + \alpha_2\, SMB_t + \alpha_3\, HML_t + \varepsilon_{it} \quad (3.2)$$

Where $\mathbf{r_{i,t}}$ is the monthly stock return calculated as explained in equation (3.1). Rf_t is the risk-free rate, $Rm_{t,}$ is the monthly return on the FTSE All-Share Index. (Rm_t- Rf_t) is the excess market portfolio return, and SMB and HML refer to the size and value factor respectively. The following paragraphs provide more details on the construction of these factors.

The factors in equation (3.2), i.e. size (SMB) and value (HML), are constructed for the UK market by Gregory et al. (2013)[7]. These factors are available on the University of Exeter database and prepared according to the UK market characteristics, which are expected to provide more reliable results. Griffin (2002) argues that country-specific three-factor models yield better explanations of the stock return variations with lower pricing error. According to Griffin (2002, p.798) "*....risk analysis using Fama and French-style models are best done on a within-country basis*". Based on these arguments, this study relies on the factors constructed by Gregory et al. (2013) for a higher level of accuracy in the regressions results. Moreover, using these factors can be considered to be a reliable source and have been used in recent UK papers that apply the Fama and French three-factor model (Balafas and Florackis 2014; Kostakis et al. 2012).

Gregory et al. (2013) construct six portfolios based on equation (3.2) and they only include the main market in the portfolios' construction and exclude the financial sector. The factors are constructed for the period 1980 to 2012, providing monthly factors for the UK market. According to the previous equation, R_m is the total return on the FTSE All-Share Index, and RF is the one-month risk-free rate. To have the size and value factors, first the firms were sorted according to the market capitalisation and two groups were created: (S: small), the firms below the median of market capitalisation and (B: big), firms above the median of market capitalisation. In the second step, firms were sorted according to the book-to-market (BTM) ratio and, using the 30th and 70th percentiles, three groups were created: H-High, M-Medium and L-Low. From the intersection of the two size portfolios and the three BTM portfolios, six portfolios were

[7] For more details on the construction of these factors: http://businessschool.exeter.ac.uk/research/areas/centres/xfi/research/famafrench/files/

constructed: SH, SM, SL, BH, BM, and BL. For example, "SH" is the intersection between the small size and high BTM portfolio and so on.

According to the portfolio construction process indicated in the previous paragraph, the SMB and HML factors are formed. The SMB factor is constructed as (SL + SM + SH)/3 – (BL + BM + BH)/3. The HML factors is (SH + BH)/2 – (SL + BL)/2. It is important to note here that, when the firms were sorted according to the BTM, Gregory et al. (2013) form all these portfolios at the beginning of October in year t, given the fact that the year-end for 22% of UK firms is in March, and for 37% it is in December. Therefore, they match these dates together and start forming the portfolios in October to find the more suitable factors portfolios construction. Another important issue is that, when the firms were sorted according to the BTM, the breakpoints were altered according to the UK market characteristics. Gregory et al. (2013) used the 30th and 70th percentiles of BTM of the firms, which is different to those used by Fama and French (1993). The differences result from the fact that the nature of the London Stock Exchange differs from the NYSE market (Gregory et al. 2013).

Because this database excludes the financial institutions, following Adams et al. (2005) and Pathan (2009), the current study uses the two-market model to calculate the idiosyncratic risk for the financial sector. Using 60 months' consecutive returns with a minimum of 36 months, the idiosyncratic risk for financial firms is the standard deviation of the residuals from the following equation:

$$r_{it} = \alpha_1 + \beta_1 Rm_t + \beta_2 Interest_t + \varepsilon_{it} \qquad (3.3)$$

Where: Where $\mathbf{r_{i,t}}$ is the monthly stock return calculated as explained in equation (3.1). $Rm_{t,}$ is the monthly return on the FTSE All-Share index, Interest is the 3-months' risk-free rate and the ε_{it} is the residuals.

3.4.2 Key Explanatory Variables

This study aims to examine the effect of board structure on corporate risk taking. In particular, the study examines the effect of board size, board independence, and CEO/Chairperson duality. The second objective of this study is to indicate the effect of female directors on corporate risk taking. In other words, does the presence of female

directors on the board increase or decrease corporate risk? The definitions and measurement of these variables are provided in the next paragraph.

Board size, using the BoardEx database, board size is measured as a natural logarithm of the total number of directors serving on the board (Cheng 2008; Florackis et al. 2009; Nakano and Nguyen 2012; Pathan 2009; Pathan and Skully 2010).

Board Independence, this variable is measured as the number of non-executive directors relative to the board size. The measurement of this variable is in line with recent UK studies (Florackis et al. 2012; Florackis et al. 2009; Florackis and Ozkan 2009a; Guest 2008, 2009, 2010; McNulty et al. 2013). In the UK, the non-executive directors are employed as part-time directors (Guest 2008). This definition is in line with the BoardEx database definition, which states that "Non-*executive director is: Any member of a company's Board who is not an employee of the company*". Therefore, this variable is extracted from the BoardEx database since this database provides the number of non-executive directors on UK boards. Further, this is the available definition for non-executive directors and no other database provides more details on directors' independence (Guest 2008).

CEO/Chairperson duality, in order to examine the effect of CEO power, this study examines whether the positions of CEO and chairperson are combined or separated. The BoardEx database provides this information and indicates when the title of the two positions is combined. Following Boyd et al. (1993), Kim and Buchanan (2008), Florackis and Ozkan (2009a) and Chen (2011), a dummy variable equal to one if the CEO is also the chairperson and zero otherwise.

Female Directors, this variable is measured as the number of female directors on the board divided by the total board size. The number of female directors is obtained directly from the BoardEx database. The measurement of this variable is similar to Levi et al. (2013), Lenard et al. (2014) and Berger et al. (2014). It is worth to note that BoardEx does not provide classification for female directors as executives and non-executives, which limit us to use this classification in the empirical analysis.

3.4.3 Control Variables

The following section provides the definition and measurement of the control variables that are included in the empirical models. Each variable is considered to be an important determinant of the corporate risk taking. In addition, the selection of these variables is backed by theoretical and empirical evidence from the previous related literature.

Firm Size

Firm size is considered to be an important variable that has been included in most of the previous empirical studies. Generally speaking, larger firms are expected to have lower performance variability as they have the ability to diversify more across their different product lines (Konishi and Yasuda 2004). Additionally, larger firms have better access to the capital market (Anderson and Fraser 2000), more experience and the ability to absorb unforeseen risk (Pathan 2009); therefore, a negative relationship is expected according to the mentioned arguments. Several empirical papers provide support for the above arguments, and report a negative relationship between firm size and corporate risk taking (see for example, Anderson and Fraser 2000; Cheng 2008; Fortin et al. 2010; Konishi and Yasuda 2004; Nakano and Nguyen 2012; Nguyen 2011; Pathan 2009). In this study, following Cheng (2008), Adams et al. (2005) and Erkens et al. (2012) firm size is measured as the natural logarithm of total assets.

Financial Leverage

A considerable amount of the previous literature indicates a positive relationship between financial leverage and corporate risk taking (Lev 1974). Firms with a high leverage ratio tend to be exposed to a higher risk of bankruptcy since the interest on the loans is treated as a legal obligation on the firm. Therefore, in the case of default the risk is increased. Therefore, more leverage may lead a firm's managers to transfer wealth from bondholders to shareholders (Leland 1998). Accordingly, a positive relationship between leverage and corporate risk is expected.

Adams et al. (2005), Erkens et al. (2012), and Nakano and Nguyen (2012) report a positive relationship between financial leverage and corporate performance variability.

However, Cheng (2008) finds that financial leverage has no impact on US corporate risk. In this study and consistent with previous studies, financial leverage is measured as total debt to total assets (Cheng 2008; Florackis and Ozkan 2009b; Nakano and Nguyen 2012; Ozkan and Ozkan 2004).

Growth Opportunities

Firms with high growth opportunities are exposed to higher risk. According to Bowman (1979), growth can be defined when the firm chooses to invest in a project with a higher expected return; this implies that growth stems from investing in risky investment. Growth opportunities are also captured in the market value of the firm (Klapper and Love 2004). In addition, firms with higher growth opportunities may need to attract more external financing, which could serve as an incentive for better governance practices to have such funds at lower cost (Beiner et al. 2006).

Nguyen (2011) uses two different proxies for growth: dividends to equity ratio and market-to-book value of assets. High ratio of market-to-book value or low ratio of dividends to equity ratio has a positive sign with idiosyncratic risk. Adams et al. (2005) use capital expenditures over sales to proxy for firm growth, but they report no significant impact on risk. Cheng (2008) also uses capital expenditures over sales but the study reports a negative relationship. Following Akhigbe and Martin (2008),Coles et al. (2006), King and Wen (2011), Barua et al. (2010) and Gonzalez and André (2014), this study uses the ratio of market-to-book value of equity as a proxy for growth opportunities.

Firm Age

The age of the firm is considered to be an important variable that may affect a firm's characteristics and objectives (Lewellyn and Muller-Kahle 2012). It is expected that an older firm is exposed to lower performance variability according to the experience and ability to handle such risk issues; in addition, firms grow in size with time so the ability to diversify risk also increases (Cheng 2008; Nakano and Nguyen 2012). In strategic management studies, evidence has been found that firm age affects organisation behaviour and risk attitude (for more details, see Fredrickson et al. 1988; Henderson

1999; Mason et al. 2003). In the same manner, in corporate governance studies, Adams et al. (2005) and Cheng (2008) provide evidence that older firms are associated with lower performance variability. This study calculates firm age as the number of years since incorporation (Adams et al. 2005; Lewellyn and Muller-Kahle 2012).

CEO Ownership

In the agency problem, which is proposed by Jensen and Meckling (1976), Amihud and Lev (1981) and Smith and Stulz (1985), managers tend to behave in a risk-averse manner, because their job in the firm is strongly connected to the change in firm value. Amihud and Lev (1981) argue that firms with lower ownership concentration tend to reduce risk through involvement in more conglomerate acquisitions. Therefore, managerial ownership is typically used to motivate managers in order to work in line with shareholders' interests and choose risky investments. The theoretical arguments provided by Jensen and Meckling (1976) and Haugen and Senbet (1981) indicate how the financing choice and investment decisions may be influenced by the managerial stock and stock option holdings. According to Agrawal and Mandelker (1987), three sources of income shape the manager's total wealth. The first one is related to his/her human capital and the remaining two are related to the common stock and stock option.

Empirically, Agrawal and Mandelker (1987) document a positive relationship between managerial holdings and both firm variance and firm leverage. The authors indicate that, as the manager's holdings increase, his/her selections tend towards investments that are more variable. Laeven and Levine (2009) report that banks with controlling shareholders tend to have more risk. Similarly, a positive relationship has been documented by Adams et al. (2005). On the other hand, Kim and Buchanan (2008) find no significant relationship between CEO ownership and managerial risk taking. In this study and using the BoardEx database, CEO ownership is measured as the percentage of shares owned by the CEO. The measurement of this variable is in line with prior studies (Adams et al. 2005; Cheng 2008; Kim and Buchanan 2008).

Industry and Year Dummies

The level of corporate risk taking may differ across industries (Adams et al. 2005; Cheng 2008). To control for these differences, this study includes a dummy variable for each industry (Boone et al. 2007; Coles et al. 2008; Linck et al. 2008). More importantly, Boone et al. (2007) argue that controlling for industry fixed effect mitigates the endogeneity concern. Firms that operate in the same industry have similar circumstances and production technologies, thus include industry fixed effect control for economic factors in these environments, which may jointly determine board structure variables (Boone et al. 2007).

Using the Industry Classification Benchmark (ICB) (FTSE Factsheet 2008), this study classifies both the financial and the non-financial sectors into different industries. For instance, the study employs nine dummies for the non-financial sector, as follows. IN1 relates to "Oil & Gas", IN2 "Basic Material", IN3 "Industrials", IN4 "Consumer Goods", IN5 "Health Care", IN6 "Consumer Services", IN7 "Telecommunications", IN8 "Utilities", and IN9 "Technology". Similarly, in the financial sector, IN1 relates to banks, IN2 relates to insurance firms, IN3 relates to financial service firms and IN4 relates to real estate firms.

Furthermore, following most of the prior corporate governance studies, 10 dummies are included to control for years in this study (Guest 2008; Linck et al. 2008; Pathan 2009). Given the possibility that the variables of the study may change over the time period of the study, therefore including year dummies will control for the trends of board structure variables (Guest 2008). In addition, the time span of the study covers the recent financial crisis. To capture this effect, the study includes a dummy variable for each year in the study time period. These dummies take the value of either one or zero for each year from 2003 to 2012. For example, Y1 stands for the year 2003, Y2 stands for the year 2004, etc., up to Y10).

Table 3.4 Variables: Definitions and Source

Variable	***Code***	***Source & Items used***
Dependent Variables		
Total Risk	*TR*	***Datastream***: RI Total return index
Idiosyncratic Risk	*IDO*	***Datastream***: RI Total return index, size and value factors obtained from http://businessschool.exeter.ac.uk/research/areas
Explanatory Variables of Governance		
Board Independence	*NED*	***BoardEx Database***: the number of independent directors relative to the board size.
Board Size	*BSIZE*	***BoardEx Database***: The natural logarithm of total number of directors on the board
CEO/Chairperson duality	*DUL*	***BoardEx Database***: A dummy variable equal to (1) if the positions of CEO and chairperson are combined, (0) otherwise.
Female Director	*GEN*	***BoardEx Database***: The percentage of female directors on the board.
Control Variables		
Financial Leverage	*LEV*	***World Scope Database:*** Total debt (WC03255)/ Total assets (WC02999).
Firm size	*FSIZE*	***DataStream Database***: ln(Total Assets): (WC02999)
Firm Age	*AGE*	***World Scope Database***: Number of years since incorporation (WC18273)
Growth opportunity	*MTBV*	***World Scope Database*** : (MTBV): market to book value of equity
CEO Ownership	*CEOWN*	***BoardEx Database***: The percentage of shares owned by the CEO
Industry	*IN*	A dummy variable for each industry sector
Year	*Y*	A dummy variable for each year

3.5 Descriptive Statistics

This section presents the descriptive statistics of the dependent, independent and control variables in both non-financial and financial sectors. Table 3.5 uses mean standard deviation, minimum, median, maximum and percentiles to describe the data over the period 2003-2012. According to Table 3.5, the average total risk in the UK non-financial sector is 11.7% with a standard deviation of 8.4%. The average value of idiosyncratic risk in the non-financial sector is 8.3%. The values for idiosyncratic risk range from zero to a maximum value of 63%. These figures are consistent with recent UK studies (Gregory-Smith et al. 2014; Guest 2008, 2009, 2010). In the financial sector, Table 3.5 indicates that the average (standard deviation) for total risk is 8.2% (4.5%) respectively.

Table 3.5 also indicates that on average eight (seven) directors serve on the UK non-financial (financial) boards. The minimum number is two and the maximum is 22 directors in both sectors. Compared with the US studies, the size of the UK boards seems to be slightly smaller. For example, recent US studies by Cheng (2008) and Wang (2012) report that the average board size in the US is 9.2 directors. The figures on board size are consistent with recent UK studies that report similar figures (Dahya et al. 2009; Florackis and Ozkan 2009a; Gonzalez and André 2014).

The role of the non-executive directors is considered to be important in monitoring and supporting the firm strategy. Therefore, most of the governance codes around the world recommend increasing their existence on the board. The descriptive statistics in Table 3.5 show that the percentage of independent directors on average is 59.8% (79%) for the non-financial (financial) sectors respectively. Ozkan (2007) reports that, on average, the proportion of non-executive directors on UK boards is 55.63. The figures in Table 3.5 with respect to board independence show a high level of compliance with the recent UK governance code (2010), which recommends that at least half of the board should be independent.

Table 3.5 Descriptive Statistics

This table presents analytical descriptive statistics of the risk-taking measures, board structure characteristics and all the control variables that are used in the empirical analysis for both sectors. See Table 3.4 for variables' definitions and data source.

Panel (A) Non-Financial Sector							
	Mean	***St. Dev.***	***Min***	***25%***	***Median***	***75%***	***Max***
TR	0.117	0.084	0.000	0.066	0.099	0.137	0.330
IDO	0.083	0.06	0.000	0.010	0.024	0.054	0.632
BSIZE	8.071	2.362	2.000	6.000	8.000	9.000	20.000
NED	0.598	0.129	0.000	0.500	0.600	0.667	0.92
DUL	0.035	0.184	0.000	0.000	0.000	0.000	1.000
GEN	0.070	0.093	0.000	0.000	0.000	0.125	0.600
CEOWN	0.019	0.057	0.000	0.000	0.001	0.008	0.361
FSIZE	13.073	1.759	9.311	11.795	12.883	14.200	17.644
LEV	0.216	0.189	0.000	0.056	0.191	0.320	0.894
MTBV	0.752	0.940	-4.605	0.247	0.747	1.247	3.684
Age	34.572	33.890	1.000	10.000	20.000	52.000	121.340
Panel (B) Financial Sector							
TR	0.082	0.045	0.010	0.055	0.072	0.095	0.282
IDO	0.054	0.027	0.001	0.004	0.019	0.022	0.311
BSIZE	7.268	2.977	2.000	5.000	6.000	9.000	22.000
NED	0.795	0.227	0.000	0.600	0.875	1.000	0.96
DUL	0.013	0.113	0.000	0.000	0.000	0.000	1.000
GEN	0.079	0.111	0.000	0.000	0.000	0.167	0.750
CEOWN	0.010	0.061	0.000	0.000	0.000	0.001	0.634
FSIZE	13.318	2.010	10.037	11.998	12.885	13.980	20.642
LEV	0.125	0.173	0.000	0.000	0.047	0.190	0.721
MTBV	0.954	0.665	-2.813	-0.248	0.931	0.182	2.217
Age	38.660	37.804	0.000	12.000	20.000	58.750	139.000

As noted from Table 3.5, in the non-financial sector around 4% of the firms covered by the study sample combine the role of CEO and the board chair position. However, in the financial sector the firms show more compliance where the average (median) of CEO/Chairperson duality is 1.3% (0.000). McNulty et al. (2013) report that the average CEO/Chairperson duality in UK firms is 4.9%, which is quite similar to the figures

above. The average of female directors on the UK non-financial boards is around 7% with a standard deviation of 9%. Moreover, the highest percentage of females in the non-financial sector is around 60%. However, the figures in the financial sector are close where the average is around 8%, the standard deviation is 11% and the maximum value is 75%. These results are in line with recent UK studies (Dowling and Aribi 2013; Gregory-Smith et al. 2014).

The final part of Table 3.5 describes the control variables. On average, 7.4% of the non-financial firms have a risk committee. However, in the financial sector the average increased to 10.9%. The average CEO ownership is 2% with a maximum value of 36% in the non-financial sector. This is consistent with the results reported by Ferri and Maber (2013). The mean (standard deviation) of CEO ownership is 1% (6%) with a maximum value of 63% in the financial sector. The firm size, which is expressed in natural logarithm, has an average of 13 and ranges from a minimum value of 9.3 to a maximum value of 17.6 in the non-financial sector. These figures are consistent with recent UK studies (McNulty et al. 2013). The table above shows that in the financial sector the size of the firms is larger since the values range from 10 to 20.6 expressed in natural logarithm.

The leverage, age and growth opportunities in the non-financial sector have mean (median) of 21.6% (19.1%), 34.5 (20) and 75.2% (74.7%) years respectively. In the financial sector, the value of leverage ranges from zero to a maximum value of 72%. However, the maximum value of leverage in the non-financial sector is 89.4%. Growth opportunities range from -2.81 to 2.21 with an average of 0.954 in the financial sector. Finally, the firms in the financial sector seem to be older with an average of 38.6 years, standard deviation of 20 years and a maximum value of 139 years. Similar results on these variables are reported in recent UK studies (Florackis and Ozkan 2009a; Weir et al. 2002).

3.6 Correlation Matrix

The section presents the correlation matrix between risk measures, governance and control variables. The aim of providing a correlation matrix is to detect the existence of high multicollinearity among independent variables. This problem means that two variables may have almost perfect linear relationship in the model (Gujaratı 2004). In the presence of multicollinearity, several problems could appear in the regression analysis. High correlation between variables makes the estimation process difficult, meaningless and hard to reach general findings (Hsiao 2003, p. 184).

From a statistical point of view, if the correlation between variables exceeds 80%, this may threaten the validity of the regression analysis (Gujaratı 2004). Moreover, one of the most common tests used to check for this problem is called the variance inflation factor (VIF), which is calculated as follows:

$$\mathbf{VIF} = \frac{\mathbf{1}}{\boldsymbol{tolerance}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.5)$$ where the $\boldsymbol{Tolerance = 1 - R^2}$

R^2: is the coefficient of determinations

It has been suggested that, if the VIF exceeds 10, which means that R^2 exceeds 90%, this indicates a multicollinearity problem for that variable (Gujaratı 2004, p.362). Accordingly, this study calculates the VIF for all the variables in the model using total risk and idiosyncratic risk as the main dependent variables and for both sectors. The correlation between variables and the results of VIF tests indicate that multicollinearity is not a problem in our dataset. Tables 3.6 and 3.7 present the correlation matrix for the non-financial and financial sectors respectively.

Table 3.6 indicates a positive and significant relationship between board size and firm size. This is consistent with the theoretical predictions since large firms require more directors due to their complexity (Boone et al. 2007). Further, the correlation between board size and firm size is 61.9%. This value is considered to be the highest in the non-financial sector. However, since it is still less than 80% this means no multicollinearity problem exists in the model. In addition, another high value is captured between board independence and firm size where the correlation is 35.6%. Board independence is positively and significantly correlated with firm size. Similarly, Table 3.7 indicates that

the highest value, which is between board size and firm size, is 63.2%. This value is still accepted and we do not consider the multicollinearity problem.

Table 3.6 Correlation Matrix Non-Financial Sector

	TR	IDO	*BSIZE*	*NED*	*DUL*	*GEN*	*CEOWN*	*LEV*	*AGE*	*MTBV*	*FSIZE*
TR	1.000										
IDO	0.306*	1.000									
BSIZE	-0.213*	-0.156*	1.000								
NED	-0.027*	-0.034*	0.137*	1.000							
DUL	0.041*	0.027	-0.010	-0.094*	1.000						
GEN	0.047*	0.037*	0.143*	0.143*	-0.018	1.000					
CEOWN	0.022	0.013	-0.139*	-0.171*	0.349*	-0.045*	1.000				
LEV	-0.140*	0.029*	0.147*	0.092*	-0.044*	0.043*	-0.131*	1.000			
AGE	-0.051*	-0.085*	0.075*	-0.006	-0.058*	0.026	-0.152*	0.025	1.000		
MTBV	0.261*	0.148*	0.095*	0.003	-0.003	0.032*	0.080*	0.082*	0.067*	1.000	
FSIZE	-0.253*	-0.216*	**0.619***	**0.356***	-0.050*	0.206*	-0.183*	0.256*	0.170	-0.057*	1.000

*Indicates significance level at 5%

Table 3.7 Correlation Matrix Financial Sector

	TR	*IDO*	*BSIZE*	*NED*	*DUL*	*GEN*	*AGE*	*LEV*	*FSIZE*	*MTBV*	*CEOWN*
TR	1.000										
IDO	0.534*	1.000									
BSIZE	0.181*	0.138*	1.000								
NED	-0.344*	-0.280*	-0.517*	1.000							
DUL	0.046	0.033	0.033	-0.128*	1.000						
GEN	-0.022	-0.037	0.078*	0.114*	-0.038	1.000					
AGE	-0.230*	-0.160*	-0.146*	0.139*	0.038	0.173*	1.000				
LEV	0.243	0.183*	0.124*	-0.279*	0.036	-0.028	0.068*	1.000			
FSIZE	0.089*	0.073	**0.632***	-0.272*	0.011	0.121*	0.003	0.142*	1.000		
MTBV	0.094	0.022*	0.320*	-0.313*	0.054	0.027*	-0.164*	-0.101*	0.139*	1.000	
CEOWN	0.233*	0.227*	0.065*	-0.143*	0.148	0.020*	-0.044*	0.088*	0.004	0.217*	1.000

*Indicates significance level at 5%

As another check for multicollinearity problem, the study calculates the VIF for the variables in the model. Table 3.8 reports the results for both sectors. As indicated above, if the VIF exceeds 10 this means there is a multicollinearity problem. However, from Table 3.8 it is clear that all the values in both sectors are less than 10. Moreover, the average VIF in the financial sector is 1.64 and in the non-financial sector it is 1.33. These values confirm that our dataset is free from multicollinearity problem.

Table 3.8 VIF Tests

	Financial		***Non-Financial***	
	VIF	***1/VIF***	***VIF***	***1/VIF***
BSIZE	3.03	0.32	1.84	0.54
NED	1.87	0.53	1.23	0.81
DUL	1.05	0.94	1.17	0.85
Gen	1.08	0.92	1.06	0.94
RC	1.49	0.65	1.02	0.97
Age	1.17	0.85	1.06	0.94
LEV	1.31	0.76	1.22	0.81
FSIZE	3.05	0.32	2.57	0.38
CEOWN	1.09	0.91	1.24	0.80
MTBV	1.38	0.72	1.08	0.92
Mean VIF	***1.64***		***1.33***	

3.7 Empirical Models

One of the most debated issues in corporate governance studies is the importance of board structure and its effect on the firms' behaviour and outcomes. Fama and Jensen (1983b, p.313) specify the main functions of the board as they have "*...the rights to ratify and monitor major policy initiatives and to hire, fire, and set the compensation of top level decision managers".*

According to agency theory, a strong governance system typically occurs when the board size is not too large, is dominated by non-executive directors, the CEO and Chair positions are separated, there is higher stock ownership by firm executives, and more leverage is used (Baysinger and Butler 1985; Pearce and Zahra 1992; Stulz 1990). Empirically, many papers provide support for the above arguments: strong governance leads to better performance (Baysinger and Butler 1985; Pearce and Zahra 1992), lower bankruptcy problem (Daily and Dalton 1994), and stable stock market performance (Harris and Helfat 1998).

The majority of the previous governance literature links board structure with corporate performance (Agrawal and Knoeber 1996; Beiner et al. 2006; Yermack 1996), while little attention has been given to the impact of board structure or presence of female directors on corporate risk taking. However, in the aftermath of the recent financial crisis the importance of risk-taking behaviour has become a serious issue, since excessive risk taking was cited as a cause of the recent crisis especially in the financial sector (Pathan 2009). In addition, recent corporate governance codes recommend higher representation of females on firms' boards. Part of these recommendations are in response to the high pressure from media, community and social groups (Martín-Ugedo and Minguez-Vera 2014). Further, the recommendations for more female representation on the corporate boards are based on many empirical papers that find a positive link between diversity and corporate value (Carter et al. 2003; Lucas-Pérez et al. 2014; Smith et al. 2006). Despite this, very few studies examine the effect of female directors on firm outcomes.

Further, the majority of corporate governance studies focus on the non-financial sector. The regulated firms, i.e. financial institutions, are usually excluded from the analysis.

Therefore, this study aims to fill these gaps by highlighting how the structure of the board and gender diversity could affect firms' risk taking. Generally, the relationship that will be investigated between the study variables can be written as: firm risk taking is a function of board structure, female directors and other firm control variables; this can be shown in the following formula:

Risk taking ~ *f* (*Board size, Independence, CEO/Chairperson duality, Diversity, Control Variables*).

Prior literature indicates that the empirical papers that examine the effect of board structure on corporate risk taking are limited. For example, Adams et al. (2005) mainly focus on the CEO power only. This paper includes the non-financial US listed companies and explicitly excludes the financial sector. Similarly, Kim and Buchanan (2008) also analyse the effect of CEO power and ownership on firm risk taking. From the literature based on the US, Erkens et al. (2012) study only the financial sector by including banks, insurance and brokerage firms. Their study focuses only on board independence and its relation with corporate risk taking. Cheng (2008) mainly studies the effect of board size on firm risk taking. Similarly, Cheng (2008) excludes the financial sector and focuses only on the non-financial sector.

With the exception of Pathan (2009), who include more aspects of the board structure, all the previous studies focus on one or two characteristics of the board. Pathan (2009) studies how a strong board in terms of size, independence, and duality may affect corporate risk-taking. Pathan (2009) only covers the US large BHCs. However, this study aims to include both sectors, i.e. financial and non-financial firms. Compared to the above-mentioned studies, the sample of the current study includes large and small firms to avoid sample selection bias. Moreover, none of these studies includes the effect of female directors in their models.

This study employs the same empirical models to conduct the analysis in the non-financial and financial sectors. Following Erkens et al. (2012), who include the full US financial sector, i.e. banks, insurance companies and brokerage firms, this study does not use any specific items from bank statements such as loans or deposits. Therefore, our model can be used for the analysis in both sectors. Moreover, the empirical models

in this study are similar to Adams et al. (2005), Cheng (2008) and Erkens et al. (2012). Following these papers, this study develops model (3.6) for the first empirical chapter. Model (3.6) examines if the board structure of the UK listed companies determines corporate risk. The main explanatory variables include board size, ratio of non-executive directors as a proxy for board independence and the CEO/Chairperson duality in the firm. In the next empirical chapter, the study highlights the effect of female directors on corporate risk taking. To test this relationship, the study develops model (3.7) where the main explanatory variable is female directors.

$$Corporate\ Risk\ taking_{it} = \alpha + \alpha_1\ ln\ (BSize)_{it} + \alpha_2\ Non\text{-}executive\ directors_{it} + \alpha_3\ CEO/Chairperson\ duality_{it} + Control\ variables + \varepsilon_{it}^{8} \ldots\ldots \quad (3.6)$$

Control variables include firm size, financial leverage, firm age, growth opportunities, CEO ownership and dummies for years & industries.

To examine the effect of female directors, model (3.7) will be used in the second empirical chapter:

$$Corporate\ Risk\ taking_{it} = \alpha + \alpha_1\ (Female\ Directors)_{it} + Control\ variables + \varepsilon_{it} \ldots. \quad (3.7)$$

The control variables include: board structure variables (ln (BSize), independence and CEO/Chairperson duality), firm size, financial leverage, firm age, growth opportunities, CEO ownership and dummies for years & industries.

3.8 Analytical Procedures

This section presents the analytical strategies that will be used in the empirical chapters. In the first place, this section introduces the nature of data employed in the study, i.e. panel data. Additionally, the pros and cons of using panel data are also discussed and explained. More importantly, this section provides a detailed explanation of the dynamic panel estimator system GMM. The unique characteristics and features of this estimation method are also highlighted. However, to deliver a clear picture of the

[8] See section 3.4 for variable definitions and measurement procedures.

estimation method it is important to explain the endogeneity problem since it is the main concern in this study.

3.8.1 Panel Data

In order to analyse the relationship between the variables in which we are interested, the study employs an unbalanced panel dataset. Panel data become a central issue in most of the quantitative analysis due to the advantages that overcome the limitations in the traditional analysis methods. The main goal of using panel data in this study is to increase precision of the estimations (Gujaratı 2004). Panel data refers to the pooling of observations both across firms and over time. In other words, panel data is a time series of cross-sectional data, which therefore provides multiple observations on each individual firm in the sample (Baltagi 2001). The combination of the two dimensions provides a dataset of N ×T observations, which solves many statistical problems. Pooling many time periods for each cross-sectional observation provides a more efficient estimation. Further, panel data is described to be a balanced panel if the number of time series observations is the same for all the units in the panel. However, different time series observations in the panel lead to an unbalanced panel (Gujaratı 2004).

Using panel data provides several advantages and enhances the efficiency of the analysis. First, Baltagi (2001, p.8), among others, indicates that panel data provides more efficient econometric estimates through "*more informative data, more variability, less collinearity among the variables, more degree of freedom and more efficiency*". Second, unlike time series or cross-sectional data, panel data is more able to control for heterogeneity among datasets (Baltagi 2001; Hsiao 2007). Third, applying panel data results in fewer econometric problems, especially the effects of missing or unobserved variables (Hsiao 2007). Fourth, panel data is more efficient in dealing with more complex models, which is difficult to apply using time series or cross-sectional data. Fifth, by capturing both dimensions, panel data involves repeating analysis for the cross-sectional data over time which allows us to study the dynamics of change (Gujaratı 2004). Finally, in large aggregated datasets, panel data helps to reduce the bias in the investigation (Hsiao 2007).

Despite the advantages of using panel data, in most cases it poses some econometrical problems. One of the common problems in the panel dataset is heteroscedasticity, also known as unequal spread or variance. According to Hsiao (2003, p. 55), "*Many panel studies involve cross-sectional units of varying size. In an error-components setup, heteroscedasticity can arise because the variance* $\sigma^2_{\alpha i}$ *of* αi *varies with i or the variance* σ^2_{ui} *of* u_{it} *varies with i, or both* $\sigma^2_{\alpha i}$ *and* σ^2_{ui} *vary with i".* The presence of such a problem can lead to invalid inference and biased standard error estimation (Gujaratı 2004).

Serial correlation is another problem that could arise in panel data studies; it is sometimes referred to as autocorrelation. Gujaratı (2004, p. 442) defines serial correlations as *"correlation between members of series of observations ordered in time [as in time series data] or space [as in cross-sectional data]".* The effect of serial correlation is similar to heteroscedasticity on the data, in which it may lead to invalid estimation (Gujaratı 2004) and affect the significance test, thus the " t " and " f " values may be misleading (Wooldridge 2002). The most common way in the literature to deal with these issues is to correct the standard error for both serial correlation and heteroscedasticity. Huber-White variance estimator (White 1980) is one of the commonly used methods that provide a robust and efficient estimation of the standard error that corrects for violated variances. In this study, the main estimation method, system GMM, corrects for heteroscedasticity and serial correlation by reporting robust standard errors, which solves such issues in the dataset. See Wooldridge (2002) for more details on robust standard errors.

3.8.2 Outliers

Another problem arising in the dataset is outliers. An outlier is a data point that differs from the rest of pattern in the study sample (Gujaratı 2004). Outliers, typically known as extreme values, may lead to a bias in the estimation parameters and reduce the significance of the statistical model (Gujaratı 2004). The literature indicates different ways to deal with this issue. For example, one of the common procedures is removal. However, this may increase the missing data and therefore affect the results of the regression analysis. Another common way to deal with outliers is winsorisation. In this treatment all the values above or below a certain point are substituted with a value

calculated according to the upper and lower percentiles. Consistent with the majority of research papers, winsorisation is applied to all the financial variables where data points lie above 99% and lower than 1% percentiles were winsored (Shumway 2001; Chava and Purnanandam 2011; Poletti-Hughes and Ozkan 2014).

3.8.3 Endogeneity

In most of the corporate governance studies, the endogeneity issue is the most important concern. However, most of the research papers in the corporate governance area fail to deal with this problem properly. If endogeneity is present in the model, this leads to bias and inconsistent parameters' estimation. The endogeneity problem mainly rises from three sources, ***simultaneity***, ***unobservable heterogeneity*** and ***dynamic endogeneity***. In the first type, simultaneity arises when the dependent variable and one or more of the explanatory ones are determined in equilibrium; in this case, the first variable causes the other and the reverse is true (Roberts and Whited 2012). According to Gujaratı (2004, p.753-754), "*simultaneity problem arises because some of the regressor are endogenous and are therefore likely to be correlated with the disturbance, or error, term*". In a corporate governance context, most of a firm's financial characteristics could be viewed as endogenous because the board choices regarding these variables are made according to the expected risk taking (Gregory-Smith et al. 2014).

Unobservable heterogeneity, also known as omitted variables, occurs when the relationship between two or more variables in the regression model is influenced by another variable but unobservable (Schultz et al. 2010; Wintoki et al. 2012). The problem here is that these omitted variables appear in the error term in the regression model instead of being with the independent variables. If there is a correlation between these omitted variables and other variables in the model, in this case we are dealing with an endogeneity problem in our regression model (Hsiao 2003). In the governance-risk taking relation, firm-specific characteristics – also known as firm fixed-effects – could influence board structure variables, firm financial characteristics and risk-taking behaviour in the firm, but are unobservable and difficult to measure. For example, the skills and level of risk aversion of the firm's CEO may influence the firm's risk taking (Haubrich 1998; Schultz et al. 2010; Wintoki et al. 2012).

The last source of endogeneity is known as dynamic endogeneity, which is usually ignored in most corporate governance studies (Wintoki et al. 2012). This occurs when current board structure, firm's financial characteristics and risk taking of the firm are related to firm's past risk; in this situation we have a dynamic relationship (Wintoki et al. 2012). For example, poor previous record of firm performance may lead to change in current board structure, usually poor performance followed by an increase in the presence of non-executive directors on the board of directors (Hermalin and Weisbach 1991).

In the context of corporate governance studies, many empirical papers provide evidence that the board structure is endogenously determined (Adams and Ferreira 2007; Harris and Raviv 2008; Hermalin and Weisbach 1988; Raheja 2005). These papers discuss the endogenous relationship between board structure and firm-specific characteristics. Mainly they are based on three hypotheses: the scope of operations hypothesis, the monitoring hypothesis, and the negotiation hypothesis. According to the first hypothesis, as firms grow and become more diverse they require additional board members to deal with these complex processes (Coles et al. 2008; Lehn et al. 2009). This argument is in line with Fama and Jensen (1983b) where the complexity of a firm's operations needs a larger board. Based on this hypothesis, board size is positively related to firm size and this is empirically supported in many papers (Denis and Sarin 1999; Yermack 1996).

The scope of operations hypothesis suggests that the firm's complexity also affects the independent directors on the board (Coles et al. 2008). Firms that are more complex suffer more from agency problems and thus require more independent directors to monitor these complex operations (Lehn et al. 2009; Mayers et al. 1997). Accordingly, independent directors are positively related to firm complexity. The most common proxies that are used for firm scope and complexity are the firm's size, age, and number of business segments (Boone et al. 2007).

The monitoring hypothesis assumes that firms with higher risk will have smaller boards and fewer independent directors (Boone et al. 2007; Linck et al. 2008; Raheja 2005). As the information asymmetry increases, independent directors will be ineffective monitors since the insiders have most of this information (Coles et al. 2008). However,

the board will include more independent directors if the monitoring cost is low and the managerial private benefits are high. Put differently, this hypothesis argues that board size and independent directors are positively related to the managerial private benefit and negatively to the monitoring cost (Boone et al. 2007). The common proxies for cost of monitoring are market-to-book ratio, R&D expenditures, the variance of the firm's stock return, and CEO ownership (Boone et al. 2007; Coles et al. 2008; Linck et al. 2008).

The last hypothesis, i.e. negotiation hypothesis, states that the ratio of independent directors on the board is negatively related to the power and influence of the CEO. This argument is basically found in the model developed by Hermalin and Weisbach (1998). The main point here is that the structure of the board depends on the bargaining power between CEO and independent directors. The monitoring of the board will decrease as the ability of the CEO increases. One common proxy for the CEO's abilities is the firm's past performance. This means that there will be a negative relationship between independent directors on the board and past performance, which is considered to be a dynamic endogeneity, which has been discussed in the previous paragraphs.

In addition to the above arguments, past corporate risk could affect current board structure from another angle. In the risk taking-governance relationship, most of the firm's financial characteristics are related to the past corporate risk taking, and in section (4.4.2) this study provides empirical evidence on these relationships. Accordingly, board structure is determined by past corporate risk taking through the effect of past corporate risk taking on current firm characteristics. Therefore, it is important to conduct the analysis after controlling for all the endogeneity sources, especially the dynamic one. Following Wintoki et al. (2012), this study employs two step dynamic panel estimator system GMM in order to control for all the endogeneity types. System GMM overcomes the limitations of the traditional estimation methods that are commonly used. The next section provides more details on this estimation method.

3.8.4 Estimation Method

The previous section discussed the main econometric problems that may arise in the dataset. However, controlling for endogeneity in the empirical model is considered to be the main challenge in this study. The traditional estimation methods fail to control for the three types of endogeneity that were indicated in the previous discussion. Before explaining how system GMM helps to control for these issues, the limitations of the most popular estimation techniques in the literature, i.e. OLS and Fixed Effect, are discussed.

OLS Regression

The OLS technique is very popular and common in linking cause and effect in a regression model. However, in order for the OLS to be the best choice in the estimation, the errors in the model should have the same variance or what is technically called homoscedasticity, and also be independent from each other (Podestà 2002). The situation in most of the dataset is not the case; when the OLS is applied to panel data in most cases it provides biased or inconsistent results. Hicks (1994, p. 171 -174) indicates that the errors from the pooled data regression tend to be complicated and therefore violate the general assumption of OLS.

According to Hicks (1994), the violation of the OLS assumptions may result from the following reasons. First, errors might be serially correlated, in which they are not independent from one period to another. This may happen because of the interdependence of the observations that describe them across time. Consequently, the error from pooled regression is described as autocorrelated. Second, errors tend to be heteroscedastic, which means they may have differing variance across ranges or subsets of nations (Hicks 1994, p. 172). Third, errors might be non-random across spatial and/or temporal units, because parameters are heterogeneous across subsets of units (Hicks 1994). Accordingly, and because of the mentioned complexity in the errors from the pooled data, we can say that applying OLS is not a valid method in this study.

Fixed Effect Regression

Another popular estimation method is using the fixed effect model or what is also called the Least-Squares Dummy Variable (LSDV). In the fixed effect estimation, each individual firm could have a different intercept due to the heterogeneity between firms which results from different managerial style or managerial philosophy among others (Gujaratı 2004). Although the intercept varies across firms, it is constant over time and from here this model is known as the fixed effect model (time invariant) (Gujaratı 2004, p. 642). Fixed effect controls for characteristics within observations that may bias outcomes by eliminating the impact of time-invariant characteristics from the predictor and consequently we get the net effect. For more details on the fixed effect estimation model see Wooldridge (2002, p.265-291).

Using the fixed effect model is mostly suggested especially in the presence of the unobserved firm fixed effect (Wooldridge 2002). However, fixed effect is not a suitable estimation method in this study for many reasons. First, board governance variables are relatively persistent, i.e. do not vary over time (Hermalin and Weisbach 1998). For the fixed effect estimate, it requires substantial variation within the panel to generate precise results (Pathan 2009). Accordingly, fixed effect will not be suitable for the analysis, as the variation mainly arises in the cross section instead of the time series. Pathan (2009, p. 1343) suggests not using fixed effect in such cases "*as it would be absorbed or wiped out in 'within transformation' or 'time-demeaning' process of the variables".*

Second, according to Baltagi (2001), in most panel datasets we have a large N and small fixed T, and this is the case in this study where N = 589 and T = 10, in the case of the non-financial sector, for instance. Therefore, fixed effect estimation is inconsistent. Third, applying fixed effect will result in losing a substantial amount of degree of freedom (Baltagi 2001). In summary, the fixed effect model is proposed in the literature to account for heterogeneity across observations in the dataset. However, in corporate governance studies, which are characterised by time-invariant variables, large N and small fixed T, this method leads to inconsistent results.

System GMM

Based on the above discussion, it is clear that, in order to obtain valid, consistent and unbiased results, it is very important to rely on a well-developed and robust method. Following Wintoki et al. (2012), this study applies a two-step dynamic panel generalised method of moments estimator. This method is also known as the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This methodology allows us to gain from several advantages that are not available in the traditional methods. Wintoki et al. (2012, p.3) provide a brief summary of these advantages. First, system GMM controls for unobservable heterogeneity by including the firm fixed effect where OLS fails to control. Second, the current values of the explanatory variables are allowed to be influenced by the past value of the dependent variable in the model and by doing so we control for the dynamic endogeneity (Wintoki et al. 2012).

Third, using two-step system GMM provides us with a superior result to that obtained from the standard first-differenced GMM estimators (Roodman 2006; Wintoki et al. 2012). The main problem in the standard GMM estimators is that those variables that are in levels could be weak instruments (Arellano and Bover 1995; Blundell and Bond 1998). In addition, the impact of measurement errors may be exacerbated on the dependent variables in the first differencing (Griliches and Hausman 1986).

To overcome these shortcomings in the standard GMM estimators, Arellano and Bover (1995) and Blundell and Bond (1998) suggest that the first-differenced variables can be used "*as instruments for the equations in levels in a "stacked" system of equations which includes the equations in both level and differences"* (Blundell and Bond 1998, p.126). Under the additional restriction where all the moment conditions available can be exploited by the linear GMM estimator in a system of first differenced and levels equations, the two-step GMM estimator provides more efficient estimates.

System GMM helps to mitigate the endogeneity concerns, control for heterogeneity, and remove unobserved firm-specific fixed effects. Furthermore, it allows the use of different instruments with different lag structure for both the levels and the first differenced equations (Blundell and Bond 1998, 2000). Finally, this estimator improves

the estimation of the standard first-differenced GMM estimators by reducing the finite sample bias through the additional moment conditions of this type, which at the end provides much better precision (Bond et al. 2005). To apply system GMM, two steps are required. First, rewrite models (3.6) and (3.7) in a general dynamic form in first-differenced. It is important to note that this part, which explains how system GMM works, is taken from Wintoki et al. (2012, p. 14-16).

$$\Delta Y_{it} = \alpha + k_L \sum_L \Delta Y_{it-L} + \beta \Delta X_{it} + \gamma \Delta Control_{it} + \Delta \varepsilon_{it} \quad \ldots\ldots (3.8)$$

Where, y is the dependent variable, either total risk or idiosyncratic risk. X is the board structure variables. Control is all the control variables in the model. *L* is the number of lags, where $L > 0$, $k > L$. For the full variable definitions, see Table (3.6). In this step, the unobserved heterogeneity is eliminated through first differencing. Moreover, model (3.8) uses the lagged value of risk-taking measures, board structure variables and control variables as instruments for the current changes in these variables. According to Wintoki et al. (2012), these instruments should provide a source of variation for the current board governance variables, which means:

$$X_{it} = f(Y_{t-k}, X_{t-k}, Control_{t-k}) \quad \ldots\ldots\ldots k > L \quad \ldots\ldots\ldots (3.9)$$

Further, these lagged values should be exogenous, which means that there should be no correlation between these lagged values and the error term in our equation. Therefore, including the appropriate lagged value will be enough to capture the effect of past risk taking on the present and by doing this we control for the dynamic endogeneity in the model. More importantly, the firm's history beyond these lags should be exogenous and can be used as instruments (Wintoki et al. 2012, p. 15).

However, as indicated in the above discussion, first differencing still suffers from some econometric problems. To mitigate these weaknesses the equations in levels are included in the estimation. In this step, the variables in the first differencing are used as instruments for the equations in level and this is system GMM.

$$\begin{bmatrix} Y_{it} \\ \Delta Y_{it} \end{bmatrix} = \alpha + k \begin{bmatrix} Y_{it-L} \\ \Delta Y_{it-L} \end{bmatrix} + \beta \begin{bmatrix} X_{it} \\ \Delta X_{it} \end{bmatrix} + \gamma \begin{bmatrix} Control_{it} \\ \Delta Control_{it} \end{bmatrix} + \varepsilon_{it} \quad \ldots\ldots (3.10)$$

Finally, the equations in levels in model (3.10) still suffer from unobserved heterogeneity. To mitigate this issue,Wintoki et al. (2012) suggest that the correlation between board structure and control variables with the unobserved effects is assumed to be constant over time.

In summary, this study employs two-step dynamic panel system GMM as the main estimation method for the empirical models. The limitations in the traditional analysis technique especially in dealing with endogeneity concerns justify using system GMM to provide valid and consistent results. Further, the software package that is used in data analysis is "STATA 13", which is considered to be an advanced statistical program which provides a variety of analysis test options to check and analyse the data.

3.9 Summary

This chapter has described the data and research methods that are applied in the empirical chapters. The data for this study was collected from different sources; for example, market data were extracted from the Datastream database, accounting data from the Worldscope database and governance variables from the BoardEx database. The criteria for constructing the study sample are also explained for both the financial and the non-financial sectors. The sample covers all the listed public corporations in the FTSE All- Share Index, over the period 2003-2012.

Moreover, in this chapter, complete descriptions for the variables used in the empirical models have been provided. It identifies how the dependent, independent and control variables were selected and measured. Further, the study has adopted two models where in the first one it examines the effect of board structure on corporate risk taking. The second model, however, examines the effect of female directors on corporate risk taking.

Finally, in term of methodology, this chapter has explained why the study uses a dynamic framework analysis. Following Wintoki et al. (2012), this study employs a dynamic panel system GMM to fully control for any endogeneity concerns, since the traditional estimation methods fail to control for the three types of endogeneity, especially the dynamic endogeneity.

Chapter 4

Board Structure and Corporate Risk Taking

4.1 Introduction

The board of directors is considered to be one of the most important internal governance tools. The fundamental role of the board is to provide an effective monitoring role on behalf of the firm's shareholders. In addition, the board of directors is responsible for all the strategic decisions in the firm (Fama and Jensen 1983b; Pearce and Zahra 1992). The academic literature indicates that the effectiveness of the decision-making process is highly related to the structure of the board (Jensen 1993). Furthermore, the corporate governance literature argues that the board structure in terms of board size (Eisenberg et al. 1998; Pearce and Zahra 1992; Yermack 1996), board independence (Baysinger and Butler 1985; Fama and Jensen 1983b; Kesner 1987) and CEO/Chairperson duality (Boyd 1995; Rechner and Dalton 1991) influences the firm's outcomes.

However, the majority of governance studies link board structure variables with corporate performance. This study focuses on another important dimension of the firm's strategic outcomes. This chapter examines the relationship between board structure variables and corporate risk taking; more specifically, how the board size, independence and CEO/Chairperson duality influence Idiosyncratic Risk. This chapter employs a dataset from the UK public listed companies over the period 2003-2012. More importantly, the effect of board structure is examined in two different sectors, i.e. non-financial and financial sectors. In most corporate governance studies, the regulated industries are excluded. As indicated in Chapter 2, corporate governance mechanisms may work differently due to the special characteristics of the financial institutions. Therefore, in order to compare the similarities or differences with respect to the board structure effect the analysis is conducted separately for each sector.

The rest of this chapter proceeds as follows. Section 4.2 introduces the main hypotheses of the study. Section 4.3 reports the descriptive statistics for the board structure variables in both sectors. The empirical results of the relationship between board structure and corporate risk taking are provided in section 4.4. In section 4.5, the study conducts additional tests to confirm the robustness of the results. The final section concludes and summarises the chapter.

4.2 Hypothesis Development

This section provides a detailed discussion on the formulation of the research hypotheses. These testable hypotheses were developed in order to carry out the investigation of risk-taking behaviour in the UK market. The development of the research hypotheses is theoretically based on agency theory. The central theme of agency theory is how to reduce agency cost that arises due to the separation of ownership from control (Jensen and Meckling 1976). At the heart of agency theory, the board of directors acts as the main tool for effective corporate governance. The main duty of the board is to ratify and monitor the strategic decisions on behalf of shareholders (Fama and Jensen 1983b).

One of the key responsibilities of the board is to determine the firm's risk taking. To be in line with shareholders' interests, the board should choose risky investments that maximise the wealth of shareholders (Baysinger and Butler 1985). From the agency theory perspective, the effectiveness of the board depends on its structure and characteristics (Jensen 1993; John and Senbet 1998). Prior studies do find evidence that these characteristics, such as board size, independence and CEO/Chairperson duality, affect firm outcomes (Haniffa and Hudaib 2006; Kim and Buchanan 2008; Nakano and Nguyen 2012; Wang 2012; Yermack 1996). For example, smaller boards in terms of size enhance firm value and better serve shareholders' interests (Nakano and Nguyen 2012; Wang 2012; Yermack 1996). According to these papers, agency problems are increased in larger boards, which negatively affects the decision-making process.

4.2.1 Board Size

Corporate governance studies document that board size is negatively related to corporate performance (Eisenberg et al. 1998; Yermack 1996). This negative effect can be explained as larger boards suffer from communication/coordination problems and the agency problem is more acute in larger boards. Jensen (1993) argues that, when the board size exceeds seven or eight directors, it becomes more difficult to organise board meetings and it is not even easy to reach a consensus. Therefore, as the size of the board increases the efficiency decreases and the decision-making process of the board requires more time (Hackman 1990; Jensen 1993; Lipton and Lorsch 1992).

With respect to performance variability, as indicated above, larger boards suffer more from agency problems. According to Jensen (1993), larger boards are easily controlled by the CEO; therefore most of the board's decisions are affected by the CEO's power. This mean that the CEO's power influences the corporate risk taking through its influence on the board of directors (Cheng 2008). The literature provides inconclusive results on the relationship between CEO and corporate risk. For instance, Adams et al. (2005) report a positive and significant relationship between CEO power and corporate risk. The authors build their argument on the group decision-making studies. These studies assume that, as the number of individuals who take decisions increases, this should lead to the rejection of extreme choices, and thus when the CEO is less powerful the corporate risk tends to be lower (Sah and Stiglitz 1986; Sah and Stiglitz 1991).

From a different angle, the communication/coordination problems in larger groups negatively affect the decision-making process (Cheng 2008; Nakano and Nguyen 2012). These problems slow down the decisions as more negotiation and compromise are required. In addition, the communication/coordination problems result in less extreme decisions. Extreme decisions, i.e. very risky or very safe projects, in larger boards are usually rejected; therefore larger boards are associated with lower corporate risk taking (Cheng 2008).

These arguments are also supported in social psychology studies (Kogan and Wallach 1964; Moscovici and Zavalloni 1969). These studies indicate that individuals' opinions and evaluations tend to be heterogeneous based on the different experiences and

backgrounds they have. These papers argue that, in large groups, the final decision is viewed as a compromise that reveals all these differences, and hence high-risk projects are usually rejected. This is because they need to be accepted by a large number of directors on the board. Moreover, these studies analyse the extremity and riskiness of group decision making. The results confirm that these groups take average decisions that are considered to be less extreme ones (Moscovici and Zavalloni 1969).

Corporate governance studies provide support for the above arguments. For example, Cheng (2008) confirms this negative relationship using data from the US market. The author reports that larger boards lower the variability in monthly stock returns, annual accounting return on assets, and Tobin's Q. The author indicates that this negative relationship is in line with group decision-making studies. Consistent with Cheng (2008), another piece of supporting evidence from the US financial sector. Pathan (2009) applies five different risk measures in a sample of large US banks. The study indicates that small boards serve the shareholders' interests by enhancing more risky investment. Recent studies by Chen (2011) Nakano and Nguyen (2012), Wang (2012) and McNulty et al. (2013) provide similar findings. Based on the above discussion, the following hypothesis is proposed.

Hypothesis 1*: There is a negative relationship between board size and corporate risk taking.*

4.2.2 Board Independence

Agency theory supports the increased number of non-executive directors on the board (Demsetz and Lehn 1985). The role of non-executive directors is expected to be aligned with firm shareholders and to therefore enhance the value of the firm (e.g., Dalton et al. 1998; Eisenhardt 1989; Fama and Jensen 1983b; Jensen and Meckling 1976). Those directors have the knowledge and experience which may be considered important resources for the firm (Haniffa and Hudaib 2006; Pearce and Zahra 1992). The non-executive directors are independent from management and work on behalf of shareholders to constrain the managerial opportunistic behaviour (Fama 1980; Jensen 1993; Leftwich et al. 1981). Therefore, according to agency theory it is expected that the boards with more non-executive directors better represent shareholders' interests

and thus enhance taking more risk (Fama and Jensen 1983b; Raheja 2005; Rosenstein and Wyatt 1990).

Several empirical papers provide evidence that supports the previously mentioned arguments. For example, Baysinger and Butler (1985) and Weisbach (1988) among others report that boards with a high percentage of non-executives tend to be more effective in monitoring, leading the managers to take action in the best interests of shareholders, and actively replacing the CEO after poor performance. Other authors find that boards that are dominated by non-executive directors lead to superior firm performance due to the knowledge and experience that they acquire (e.g.,Weir et al. 2002).

However, according to the monitoring hypothesis, the non-executive directors who are expected to monitor managerial actions have less information than the executives who run the daily affairs of the firm (Boone et al. 2007; Coles et al. 2008; Demsetz and Lehn 1985; Raheja 2005). Due to the lack of such details, the board independence is expected to be negatively associated with corporate risk taking (Prendergast 2000), since in uncertain environments where information asymmetry is high, board monitoring is less effective (Brick and Chidambaran 2008). This is related to the high cost of obtaining information on the investment decisions taken by management (Bargeron et al. 2010). Consistent with these arguments, Smith Jr and Watts (1992) argue that it is not an easy task for non-executive directors who lack the specific and detailed knowledge to evaluate all the firms' investment opportunities.

Cheng (2008) argues that boards with more independent directors may lead to lower levels of risk. The author suggests that those directors who came from different backgrounds may have different views and perspectives and thus may moderate the board decisions regarding risk taking. Moreover, according to the reputation hypothesis, independent directors fulfil their duties as effective monitors because they care about their own reputation in the market (Fama and Jensen 1983b). Therefore, non-executive directors may support less risky choices to avoid any firm losses or lawsuits (Pathan 2009). Any problem in a firm on whose board they sit will send a negative signal to the external market and affect their reputations(Fama 1980).

The empirical evidence on board independence and corporate risk taking is still mixed. Part of this ambiguity refers to the endogenous nature of this variable (Demsetz and Lehn 1985; Hermalin and Weisbach 1998). For example, Erkens et al. (2012) used 296 of the world's largest financial firms across 30 countries. According to their results, the independent directors have no significant effect on corporate risk. Likewise, Chen (2011), who uses a sample of non-financial firms from China, finds no effect of independent directors on corporate risk taking. Cheng (2008) reports a similar insignificant effect of independent directors on corporate risk taking.

However, Pathan (2009) reports a negative relationship between independent directors and risk taking. The researcher indicates that independent directors tend to be more sensitive to comply with regulations. Consequently, they avoid risky investments that may lead to the bank's failure. Supporting evidence is found also in the work of Gonzalez and André (2014), Kim and Buchanan (2008) and Brick and Chidambaran (2008). Based on the above discussion, the following hypothesis is proposed.

Hypothesis 2*: There is a negative relationship between board independence and corporate risk taking.*

4.2.3 CEO/Chairperson Duality

In the seminal work of Sah and Stiglitz (1991) they show how the outcome may differ under different structure of group member decision making. Their argument is that the final decision that is approved by the group members is a compromise, which reflects all the heterogeneity in the group opinion. Therefore, it is difficult to reach an agreement when it comes to extreme decisions. For this reason, very bad or very good projects tend to be rejected by the group members. Adams et al. (2005) draw an important implication from the above arguments: when there are more executives in control of the decision making, the performance variability should be lower. In other words, combining the roles of CEO and chair of the board will lead to higher risk taking.

According to agency theory, combining the two roles of board CEO and chairperson negatively affects the firm, since the CEO will be more powerful. In addition, the board

will be dominated by the CEO and will be less effective in the monitoring function (Fama and Jensen 1983b; Haniffa and Hudaib 2006; Jensen 1993; Lipton and Lorsch 1992). Corporate risk taking is an important aspect of strategic management and the cornerstone in most of the managerial decision-making process. From the agency theory perspective, managers tend to be more risk averse while shareholders are risk neutral (Jensen and Meckling 1976). Accordingly, managers tend to choose less risky investments because they want to secure their positions since this is their main concern (Baysinger and Hoskisson 1990; Kochhar and David 1996; Zahra 1995). Therefore, it is expected that, with the power concentrated in the CEO's hands, most of the decisions will serve the opportunistic managerial behaviour. Duality may lead to a lower level of risk taken by the managers (Adams et al. 2005; Chen 2011; Cheng 2008). The managerial tendency towards risk aversion combined with low board monitoring will eventually lead to lower corporate risk taking (Kim and Buchanan 2008; Pathan 2009).

The empirical results are mixed and inconsistent regarding the effect of CEO/Chairperson duality on corporate risk taking. For example, Adams et al. (2005) find a positive relationship: they report that firm variability increases as the power of the CEO increases. Similarly, Lewellyn and Muller-Kahle (2012), who focus on the link between CEO power and risk-taking behaviour and rely on both agency theory and inhibition theory of power to capture the psychological effect, report a positive relationship between CEO power and risk taking in US subprime lending firms.

Other empirical papers find that combining or separating the roles of CEO and chairperson is not related to corporate risk taking (Chen 2011; Cheng 2008). However, Pathan (2009) in his paper provides evidence consistent with agency theory assumptions. The author reports a negative relationship between CEO duality and risk taking. Similarly, Kim and Buchanan (2008) document a negative effect of CEO/Chairperson duality on corporate risk taking and the authors attribute this negative effect to the managerial risk-aversion tendency. Based on the above discussion and from the agency theory perspective, the following hypothesis is proposed.

Hypothesis 3*: There is a negative relationship between CEO/Chairperson duality and corporate risk taking.*

4.3 Descriptive Statistics

This section provides the descriptive statistics for the board structure variables. Table 4.1 presents the evolutions of board structure in both non-financial and financial sectors. In this Table, the mean and the standard deviation over the sample period are provided year by year and for the pooled years as well. In addition, Table 4.2 presents the breakdown of board structure variables according to the industry. The mean and standard deviation are provided for nine industries within the non-financial sector. In a similar way, the financial sector is broken down into four industries. In the last part in this section, Table 4.3 reports the mean differences for the board structure variables in large and small firms.

The UK board structure evolution in the non-financial and financial sectors over the sample period (2003-2012) is presented in Table 4.1. According to this table, the percentage of non-executive directors has increased from 55% in 2003 to 65% in 2012 for the non-financial sector. The financial sector shows a higher percentage of non-executive directors. The overall average of non-executive directors for the pooled sample period is 80% in the financial sector while it is only 60% for the non-financial. However, in both sectors the noticeable increases clearly prove higher compliance with the recent UK governance code regarding board independence.

Table 4.1 Evolution of UK Board Structure

This table presents the evolution of board structure variables in the UK listed firms throughout the study sample period (2003-2012). The table reports the mean and (standard deviation) for the percentage of non-executive directors (NED), CEO/Chairperson duality (DUL), and board size (BSIZE). Panel (A) reports the board structure variables for the non-financial sector while panel (B) reports them for the financial sector.

Panel (A) Mean (Standard Deviation) Non-Financial Sector											
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**All Years**
NED	0.55 (0.13)	0.56 (0.13)	0.57 (0.13)	0.59 (0.12)	0.60 (0.12)	0.61 (0.13)	0.62 (0.13)	0.63 (0.12)	0.64 (0.12)	0.65 (0.12)	0.60 (0.13)
Dual	0.04 (0.22)	0.04 (0.21)	0.04 (0.20)	0.04 (0.20)	0.04 (0.19)	0.03 (0.16)	0.03 (0.18)	0.02 (0.15)	0.02 (0.16)	0.02 (0.14)	0.04 (0.18)
BSIZE	8.21 (2.42)	8.16 (2.50)	8.12 (2.38)	8.14 (2.39)	8.04 (2.30)	8.04 (2.32)	7.92 (2.28)	7.94 (2.31)	8.00 (2.31)	8.10 (2.37)	8.07 (2.36)
Panel (B) Mean (Standard Deviation) Financial Sector											
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**All Years**
NED	0.57 (0.17)	0.62 (0.21)	0.75 (0.24)	0.80 (0.23)	0.80 (0.23)	0.82 (0.22)	0.83 (0.22)	0.84 (0.20)	0.85 (0.20)	0.87 (0.19)	0.80 (0.23)
Dual	0.01 (0.10)	0.02 (0.10)	0.02 (0.14)	0.01 (0.11)	0.02 (0.12)	0.02 (0.13)	0.01 (0.11)	0.01 (0.09)	0.01 (0.09)	0.01 (0.10)	0.01 (0.11)
BSIZE	9.50 (3.20)	9.02 (3.16)	7.80 (3.17)	7.25 (3.09)	7.13 (2.93)	6.93 (2.76)	6.77 (2.63)	6.84 (2.71)	6.88 (2.82)	6.61 (2.58)	7.27 (2.98)

The CEO/Chairperson duality seems to have a constant average in the years 2003, 2004, 2005, 2006 and 2007 with an average of 4% in the non-financial sector. More compliance for separating both titles is clear in the recent years 2010-2012, where the average decreased to 2%. In the financial sector, the average of CEO/Chairperson duality is nearly constant with an overall average of 1%. This figure indicates that the majority of financial firms separate the CEO position from the chairperson one.

Table 4.1 also provides the average number of board size in both sectors, where there is a noticeable decrease in board size. The average number of directors decreased from 9.5 in 2003 to 6.6 in 2012 for the financial sector. A similar trend but with a decreasing rate also has been documented in the non-financial sector. Table 4.1 indicates that the UK boards show more compliance with the recent corporate governance recommendations in terms of more independence, higher separation of CEO role from board chair, and sufficient board size that ranges between seven to eight directors. This compliance is noticeable especially after the recent financial crisis, i.e. in the years 2010, 2011, and 2012.

Table 4.2 reports the mean (standard deviation) for the board structure variables according to the industry breakdown. Within the non-financial sector, the table presents the figures for nine industries. As shown in Table 4.2, utilities and telecommunication industries have the largest board size with an average of 9.52 and 9.35 respectively. With respect to the board independence, the boards of directors in the basic material industry are dominated by non-executive directors with an average (standard deviation) of 65% (13%). Table 4.2 also indicates that 6% of the telecommunications boards combine the CEO and chairperson roles. This ratio is considered to be the highest in the non-financial sector.

The figures in the financial sector are slightly different, especially the board size. Table 4.2 panel (B) shows that the average number of directors on banks' boards is 14.39. This is considered to be too large even when it is compared to the non-financial sector. However, the literature indicates that financial firms are operating in a more risky environment (Pathan 2009; Tao and Hutchinson 2013). Further, financial firms are more complex and huge in size and the positive relationship between board size and complexity of the firm is well documented (Boone et al. 2007; Linck et al. 2008; Raheja 2005).

The boards of directors in the insurance firms include on average 10 directors, which is considered large compared to all industries in the non-financial sector. A noticeable figure in Table 4.2 relates to the financial service firms in the financial sector. Even though these firms have the smallest board size, around six directors, the majority of those directors are independent with an average of 86%, which is the highest in both sectors. Furthermore, financial service firms have the lowest CEO/Chairperson duality, which means the majority of these firms separate the two roles. Financial service firms show the highest compliance with the recent UK governance recommendations in both sectors.

Table 4.2 Breakdown of Board Structure Variables for Sample Firms by Industry

This table reports the mean (standard deviation) for board size (BSIZE), non-executive directors (NED) and CEO/Chairperson duality (DUL) for each industry. Panel (A) reports the breakdown of non-financial sector while panel (B) reports the financial sector data.

Panel (A)Non-Financial Sector			
Industry	***BSIZE***	***NED***	***DUL***
Basic Material	8.51 (2.58)	65% (13%)	2% 15%
Consumer Good	8.11 (2.35)	59% (13%)	3% 16%
Consumer Services	8.38 (2.59)	59% (13%)	4% (21%)
Health Care	7.68 (2.24)	62% (12%)	0.7% (8%)
Industrial	7.63 (1.90)	57% (12%)	3% (17%)
Oil and Gas	8.80 (2.91)	59% (11%)	5% (23%)
Technology	7.39 (1.92)	60% (11%)	4% (20%)
Telecommunication	9.35 (2.88)	62% (12%)	6% (24%)
Utilities	9.52 (2.13)	62% (8%)	0.8% (8%)
Panel (B)Financial Sector			
Banks	14.39 (2.96)	68% (9%)	0.7% (0.2%)
Insurance Firms	10.05 (2.52)	62% (11%)	4% (20%)
Financial Service Firms	6.33 (2.37)	86% (21%)	0.6% (8%)
Real Estate Firms	7.77 (2.28)	65% (20%)	2% (14%)

Table 4.3 reports the means differences of board structure variables for large and small firms. To conduct this test, firms are sorted according to the market value (MV): firms that are above median are classified as large firms and those below median are classified as small firms; see Linck et al. (2008) for a similar approach. Table 4.3 indicates that in both sectors larger firms tend to have larger boards where the mean differences are statistically significant, $p<0.01$. This is in line with the theoretical prediction which argues that larger firms are more complex and need larger boards to carry out these huge responsibilities (e.g., Boone et al. 2007; Coles et al. 2008). For board independence, the figures show that larger firms in the non-financial sector are dominated by more non-executive directors with an average of 63%. This positive relationship reveals that larger firms tend to show more compliance with corporate governance recommendations.

Panel (B) in Table 4.3 indicates that smaller firms in the financial sector are more dominated by non-executive directors. This could be attributed to the number of firms in the financial sectors. In our sample, there are few banks and insurance companies compared to the financial service firms. Finally, the average of CEO/Chairperson duality in the financial sector is higher in large firms. The case is not the same in the non-financial sector, where the average of CEO/Chairperson duality is higher for small firms.

Table 4.3 Means Differences for Board Structure Variables

This table presents the mean differences of board size (BSIZE), non-executive directors (NED), and CEO/Chairperson duality between large and small firms. Firms are sorted according to the market value: firms above the median of market value are classified as large and those below the median are classified as small. Panel (A) reports the non-financial sector while panel (B) reports the financial sector.

Panel (A)Non-Financial Sector			
	Large firms	**Small firms**	***t-statistics***
BSIZE	9.24	6.98	(32.63)***
NED	0.63	0.56	(20.36)***
Dual	0.03	0. 04	(-4.83)***
Panel (B)Financial Sector			
	Large firms	**Small firms**	***t-statistics***
BSIZE	8.722	5.650	(25.33)***
NED	0.728	0.862	(-11.94)***
Dual	0.014	0.004	(2.0036)**

4.4 The Relationship between Board Structure and Corporate Risk Taking

This section presents the empirical results from estimating the relationship between board structure variables and corporate risk taking. Following Wintoki et al. (2012), this study employs a dynamic panel estimator in order to investigate this relationship. As indicated in the methodology chapter, system GMM can control for all the endogeneity types, especially the dynamic one, and provide consistent results. Section 4.4.1 specifies the appropriate number of lags of past corporate risk to include in the model. Section 4.4.2 provides empirical evidence on the dynamic relationship between current board structure variables, past corporate risk-taking measures and past firm characteristics. The results from estimating the relationship between current board structure and corporate risk taking using the dynamic panel system GMM are presented in section 4.4.3.

4.4.1 Number of Lags Required to Capture the Dynamic Effect

Recent papers by Hermalin and Weisbach (2003), Guest (2008), Adams et al. (2010) and Wintoki et al. (2012) emphasise the dynamic endogenous relationship in the board structure variables. The authors argue that changes in corporate performance or corporate characteristics affect the subsequent changes in the board structure variables. For example, board independence from CEO control is one of the key variables that affect the board efficiency. However, this effect is unobservable, i.e. it is very difficult to determine the true independence on the board, and this in particular leads to the mixed and inconsistent results in the literature (Adams et al. 2010; Hermalin and Weisbach 2003; Schultz et al. 2010; Wintoki et al. 2012).

Hermalin and Weisbach (1988) find that three variables significantly determine the changes of board of directors. Firstly, poor performing firms tend to include more independent directors on their boards. Secondly, more executive directors are included when the CEO is close to retirement. The next CEO is expected to be from the included insiders on the board. However, once the CEO change is made, the probability of the executive directors leaving the board is increased. This reveals that changes in CEO affect board composition. Finally, firms include more independent directors when they leave a product market (Weisbach 1988). These findings are confirmed by Hermalin

and Weisbach (1991), who suggest a negative relationship between board independence and firm's past poor performance. In other words, firms performing poorly tend to increase the number of non-executive directors on their boards.

According to the previous discussion, studying the board structure variables is not an easy task. The endogenous nature of these variables and their relation to past firm performance and firm characteristics require careful treatment. Wintoki et al. (2012) argue that the past firm performance is also related to the current firm characteristics. One implication from this argument is that the current board structure also is determined by these characteristics, thus past performance also can affect current board structure through its effect on firm characteristics.

According to the above arguments and to capture the effect of past corporate risk and firm characteristics, this study follows Wintoki et al. (2012) and includes lags of dependent variable as explanatory variables. To capture the complete dynamic relationship, i.e. the effect of past risk taking on current corporate risk and current board structure, it is important to include lags of risk taking in our model, otherwise the model may be considered miss-specified (Wintoki et al. 2012). In addition, all older lags can be considered exogenous so they can be used as instruments; this is also important when applying system GMM. To determine how many lags should be included in the model, this study follows Wintoki et al. (2012) and regresses each current risk-taking measure on three lags of past risk in addition to the firm financial characteristics that are used as controls. The following model is used to determine the appropriate number of lags to be included in the main model:

$$Risk_{it} = \alpha_1 + \sum_{p=1}^{p=3} k_p Risk_{it-p} + kControl_{it} + \eta_i + \varepsilon_{it} \quad \ldots\ldots (4.1)$$

Where Risk represents ***current*** corporate risk measured by total risk (TR) or idiosyncratic risk (IDO). Control variables include leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV), and CEO ownership (CEOWN); η_i is the unobserved fixed effect and *εit* is the error term.

Table 4.4 reports the results for both the non-financial and financial sectors using total risk and idiosyncratic risk as proxies for corporate risk taking. As can be noted from

Table 4.4, for total risk in both sectors the first and the second lags are significant, which implies that including two lags for total risk will be sufficient to capture all the past effect on the present corporate risk taking. Furthermore, lag three and older will be exogenous and can be used as instruments for total risk. However, when the dependent variable is idiosyncratic risk, only the first lag is significant in both sectors. Including one lag of idiosyncratic risk will ensure that the past effect of corporate risk taking is captured. For the idiosyncratic risk, lag two and older can be used as instruments in the dynamic panel system GMM.

Table 4.4: Number of Lags for Risk-Taking Measures

This table reports the OLS regression of model (4.1). All t-statistics are based on robust, firm clustered standard errors. *, * *, * * * indicates significance at the 1%, 5% and 10% level, respectively. Year and industry dummies are included in all specifications. See Table 3.4 for variable definitions and measurements.

	Non-Financial		***Financial***	
Dependent Variable	Total Risk	Idiosyncratic Risk	Total Risk	Idiosyncratic Risk
Risk (-1)	1.092***	0.195***	1.227***	0.362***
	(0.000)	(0.000)	(0.000)	(0.000)
Risk (-2)	-0.202***	0.051	-0.293***	0.016
	(0.000)	(0.116)	(0.000)	0.742
Risk (-3)	0.032		-0.032	
	(0.394)		(0.203)	
LEV	0.028***	0.090***	0.013***	0.041***
	(0.000)	(0.000)	(0.003)	(0.009)
Age	-0.000*	-0.000***	-0.000***	-0.000***
	(0.070)	(0.001)	(0.000)	(0.000)
MTBV	-0.005***	-0.019***	-0.002**	-0.011***
	(0.000)	(0.000)	(0.030)	(0.042)
CEOWN	0.014**	-0.009	0.002	0.056
	(0.093)	(0.854)	(0.813)	(0.279)
FSize	-0.002***	-0.011***	0.000**	0.000
	(0.000)	(0.000)	(0.028)	(0.955)
R Squared	**0.82**	**0.24**	**0.80**	**0.33**

4.4.2 Board Structure, Firm Characteristics, and Past Corporate Risk Taking

The corporate governance literature suggests that the current board structure variables are influenced by the previous changes in firm performance and firm characteristics (Hermalin and Weisbach 1988, 1991). Accordingly, ignoring the dynamic effect and causality problem in our model results in biased and inconsistent relationships (Wintoki et al. 2012). In this section, the study follows Wintoki et al. (2012) and conducts an empirical test to examine how the current board structure variables and the current firm characteristics are related to the past corporate risk taking and past values of firm characteristics. This test aims to highlight if dynamic endogeneity exists in our empirical models by showing to what extent the current board structure and firm characteristics are correlated with past values of risk and firm financial characteristics.

In this test, the study regresses the current values (at time t) of board structure variables and firm financial characteristics and the changes in these values (t-1 to t) on the past corporate risk measures and past values of firm characteristics. The following models are used to examine these relationships.

$$y_{it} = \alpha + Risk_{\mathrm{it}-1} + \beta Control_{it-1} + \varepsilon_{it} \qquad (4.2)$$

$$\Delta\, y_{it} = \alpha + Risk_{\mathrm{it}-1} + \beta Control_{it-1} + \varepsilon_{it} \qquad (4.3)$$

Where: Y_{it} is the current board size, board independence, CEO/Chairperson duality and the current control variables, namely leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). Risk $_{\mathrm{it-1}}$ is past corporate total risk or idiosyncratic risk, and Control $_{\mathrm{it-1}}$ is all the control variables one year before (one lag). The same definitions hold for model (4.3) except the dependent variable is the change from (**t -1** to **t)**.

Tables 4.5 and 4.6 report the results for the non-financial sector. The dependent variable in Table 4.5 is total risk while in Table 4.6 it is idiosyncratic risk. The results in both tables are quite similar. Panel (A) in Table 4.5 reports the results for model (4.2). The results from panel (A) provide evidence on the dynamic endogeneity in the model. Past total risk and past firm characteristics determine most of the current values

in the model. For example, current board size is positively and significantly related to the past firm size. This implies that larger firms tend to increase their board size. This finding is consistent with arguments of firm complexity in which larger firms require more directors to manage them (Boone et al. 2007; Coles et al. 2008; Lehn et al. 2009).

Similarly, the table shows a positive and a significant relationship between board independence and past firm size. This implies that past firm size determines the current percentage of non-executive directors on the board. Thus, this may be explained as past firm size determines current board independence and current board independence determines current corporate risk, so both past firm size and current board independence may determine current corporate risk taking. Likewise, the CEO/Chairperson duality is related to the past growth opportunities and past CEO ownership. These significant relationships between current board structure variables and past firm financial characteristics may serve as indicators for the dynamic endogeneity in the main model.

In the same manner, Table 4.5 shows that past total risk and past firm characteristics determine all of the current values of the control variables in the model. For instance, firm size, age, growth opportunity and CEO ownership have a negative and significant relationship with past total risk. However, a positive relationship between leverage and past total risk is found in Table 4.5. Moreover, the results from panel (B) in both Table 4.5 and 4.6 show that when the variables are in level, i.e. change from (t-1) to (t), still we observe significant relationships between these changes and the past risk measures as well as the past firm characteristics. The results from panel (B) provide additional evidence on the dynamic nature of the variables in our model. Past total risk not only determines the current firm characteristics but also it determines the changes in these values as well.

Taken together, Tables 4.5 and 4.6 provide empirical evidence on the dynamic relationships in our model. Current board structure variable and all the control variables are significantly related to the risk measures and past firm characteristics. Wintoki et al. (2012) argue that board size and independence are the main variables that are endogenously determined. Likewise, Hermalin and Weisbach (2003, p.15) state that "*we tend to see independence as the true causal variable, with size, compensation, and*

board composition as correlates". Based on these results and following Wintoki et al. (2012), who argue that not only the board structure variables are endogenous but also all the firm's financial characteristics, this study considers all the board structure and control variables are endogenous except firm age and year dummies.

Table 4.5 Relationship between Board Structure, Firm characteristics, and Past TR for Non-Financial Sector

This table reports the results of OLS regressions of current board size (BSIZE), non-executive directors (NED), CEO/Chairperson duality (DUL), and current control variables, on past corporate risk and past values of control variables. Risk is measured by Total Risk (TR). The control variables include firm size (FSIZE), leverage (LEV), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). Panel A reports the results of the regressions in which the dependent variables are current levels. Panel B reports the results of the regression in which the dependent variables are the change from t-1 to t. All p-values (in parentheses) are based on robust standard errors. Year and industry dummies are included in all specifications. ***, **, * indicates significance level at the 1%, 5% and 10% respectively

Panel (A) Dependent Variables are in levels at time *t Non-Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
TR (-1)	-0.042	0.073	0.060	-11.62***	0.226***	-70.299***	-3.755***	-0.040*
	(0.733)	(0.113)	(0.316)	(0.000)	(0.001)	(0.000)	(0.000)	(0.096)
FSIZE*(-1)*	0.030***	0.026***	0.004***		0.031***	1.98***	-0.067***	-0.006***
	(0.000)	(0.000)	(0.008)		(0.000)	(0.000)	(0.000)	(0.000)
LEV*(-1)*	-0.191***	-0.022	-0.047**	3.035***		6.686	0.366***	-0.027***
	(0.000)	(0.120)	(0.023)	(0.000)		(0.125)	(0.004)	(0.000)
AGE*(-1)*	-0.000	-0.000	0.022	0.003***	0.000		-0.001***	-0.000***
	(0.417)	(0.831)	(0.875)	(0.000)	(0.112)		(0.002)	(0.000)
MTBV*(-1)*	0.039***	0.009***	0.003	-0.228***	0.014***	-2.120**		0.004 ***
	(0.000)	(0.000)	(0.332)	(0.000)	(0.000)	(0.011)		(0.004)
CEOWN*(-1)*	0.067	-0.270***	1.172***	-3.64***	-0.185***	-73.82***	0.131	
	(0.318)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.623)	
R squared	**0.05**	**0.23**	**0.15**	**0.40**	**0.22**	**0.14**	**0.17**	**0.09**
Panel (B) Dependent Variables are in levels at time *t-1* to *t Non-Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
TR (-1)	-0.059	-0.041	0.025	-0.373***	-0.125***	0.233**	0.428	0.010
	(0.352)	(0.192)	(0.527)	(0.000)	(0.000)	(0.012)	(0.144)	(0.563)
FSIZE*(-1)*	-0.005**	-0.001	0.000		-0.002**	0.009***	0.015**	0.000*
	(0.012)	(0.633)	(0.786)		(0.015)	(0.000)	(0.017)	(0.058)
LEV*(-1)*	0.010	-0.000	0.008	-0.163***		-0.082***	-0.169**	0.000
	(0.613)	(0.973)	(0.515)	(0.000)		(0.000)	(0.029)	(0.887)
AGE*(-1)*	0.000	0.000	0.000	-0.000***	-0.000		-0.000	0.000*
	(0.309)	(0.616)	(0.124)	(0.000)	(0.800)		(0.770)	(0.084)
MTBV*(-1)*	0.003	0.001	0.001	0.033***	0.008	0.017***		-0.001
	(0.404)	(0.458)	(0.518)	(0.000)	(0.630)	(0.000)		(0.326)
CEOWN*(-1)*	-0.002	-0.037	-0.031	-0.003	-0.011	-0.189**	-0.628***	
	(0.955)	(0.110)	(0.183)	(0.967)	(0.626)	(0.013)	(0.000)	
R squared	**0.009**	**0.007**	**0.005**	**0.10**	**0.036**	**0.03**	**0.28**	**0.024**

Table 4.6 Relationship between Board Structure, Firm Characteristics, and Past Idiosyncratic Risk for Non-Financial Sector

This table reports the results of OLS regressions of current board size (BSIZE), non-executive directors (NED), CEO/Chairperson duality (DUL), and current control variables, on past corporate risk and historic values of control variables. Risk is measured by idiosyncratic risk (IDO). The control variables include firm size (FSIZE)), leverage (LEV), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). Panel A reports the results of the regressions in which the dependent variables are current levels. Panel B reports the results of the regression in which the dependent variables are the change from t-1 to t. All p-values (in parentheses) are based on robust standard errors. Year and industry dummies are included in all specifications. ***, **, * indicates significance level at the 1%, 5% and 10% respectively

Panel (A) Dependent Variables are in levels at time *t Non-Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
IDO (-1)	-0.089	0.025	0.011	-4.863***	0.180***	-32.43***	-1.410***	-0.025*
	(0.183)	(0.371)	(0.704)	(0.000)	(0.042)	(0.000)	(0.000)	(0.080)
FSIZE*(-1)*	0.030***	0.025***	0.003**		0.030 ***	2.386***	-0.044***	-0.005***
	(0.000)	(0.000)	(0.021)		(0.000)	(0.000)	(0.000)	(0.000)
LEV*(-1)*	-0.187***	-0.021	-0.046**	3.157***		6.260	0.354***	-0.027***
	(0.000)	(0.134)	(0.029)	(0.000)		(0.154)	(0.006)	(0.000)
AGE*(-1)*	-0.001	-0.000	-0.000	0.004***	0.000		-0.001***	-0.000***
	(0.384)	(0.778)	(0.801)	(0.000)	(0.103)		(0.005)	(0.000)
MTBV *(-1)*	0.038***	0.009***	0.003	-0.148***	0.014***	-1.67**		0.004***
	(0.000)	(0.001)	(0.434)	(0.000)	(0.000)	(0.044)		(0.002)
CEOWN*(-1)*	0.065	-0.271***	1.172***	-3.827***	-0.184***	-73.56***	0.206	
	(0.331)	(0.000)	(0.000)	(0.587)	(0.000)	(0.000)	(0.449)	
R squared	**0.05**	**0.23**	**0.15**	**0.34**	**0.22**	**0.14**	**0.15**	**0.09**
Panel (B) Dependent Variables are in levels at time t-1 to t Non-Financial								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
IDO (-1)	-0.026	0.011	0.022	-0.122	-0.028	0.049	-0.386*	-0.006
	(0.452)	(0.594)	(0.130)	(0.146)	(0.104)	(0.235)	(0.058)	(0.621)
FSIZE*(-1)*	-0.004**	0.001	0.000		-0.001	0.007***	0.018***	0.000
	(0.013)	(0.789)	(0.768)		(0.158)	(0.000)	(0.009)	(0.257)
LEV*(-1)*	0.010	-0.002	0.007	-0.159***		-0.077***	-0.178**	0.001
	(0.622)	(0.810)	(0.545)	(0.000)		(0.001)	(0.022)	(0.710)
AGE*(-1)*	0.000	0.000	0.000	-0.000***	0.000		-0.000	0.000
	(0.287)	(0.495)	(0.124)	(0.000)	(0.985)		(0.820)	(0.121)
MTBV*(-1)*	0.004	0.002	0.001	0.037***	0.002	0.014***		-0.001
	(0.351)	(0.229)	(0.509)	(0.000)	(0.223)	(0.000)		(0.174)
CEOWN*(-1)*	-0.002	-0.036	-0.031	-0.009	-0.009	-0.192**	-0.624***	
	(0.952)	(0.121)	(0.183)	(0.898)	(0.696)	(0.013)	(0.000)	
R squared	**0.009**	**0.006**	**0.005**	**0.10**	**0.025**	**0.027**	**0.28**	**0.024**

The estimation for models (4.2) and (4.3) is repeated for the financial sector. The results are reported in Table 4.7 and Table 4.8. The results in the financial sector are consistent with those in the non-financial sector. Past total risk and past idiosyncratic risk determine most of the current board structure and current control variables. However, the strong relationship between board size and independence with past risk measures in particular is noticeable from the tables. For example, the results suggest that firms that took higher risks in the past increase their current board size. The high R^2, which is 61%, means that past total risk and past firm financial characteristics explain 61% of the current board size.

In the same context, past total risk and past firm financial characteristics determine the current board independence. The R^2 is 52%, which provides evidence for the endogenous relationship between these variables. In addition, the current control variables are significantly related to the past risk measure and to the past firm characteristics. Moreover, panel (B) in both tables shows that some variables in levels are still significantly related to the past risk measure and past firm controls. For instance, the change in CEO/Chairperson duality is significantly and negatively related to the past total risk.

The results in both tables are consistent with the results obtained for the non-financial sector. The empirical evidence in these tables is consistent with Wintoki et al. (2012), who argue that all the board structure and firm financial characteristics are endogenously determined. Accordingly, in the empirical analysis this study makes two assumptions. First, all the board structure variables and all the firm financial characteristic variables are considered as endogenous except firm age and year dummies (Wintoki et al. 2012). Second, for all the endogenous variables this study uses lag two and all the older lags as instruments (Wintoki et al. 2012).

Table 4.7 Relationship between Board Structure, Firm characteristics, and Past TR for Financial Sector

This table reports the results of OLS regressions of board size (BSIZE), non-executive directors (NED), CEO/Chairperson duality (DUL) and current control variables, on past corporate risk and historic values of control variables. Risk is measured by Total Risk (TR). The control variables include firm size (FSIZE), leverage (LEV), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). Panel A reports the results of the regressions in which the dependent variables are current levels. Panel B reports the results of the regression in which the dependent variables are the change from t-1 to t. All p-values (in parentheses) are based on robust standard errors. Year and industry dummies are included in all specifications. ***, **, * indicates significance level at the 1%, 5% and 10% respectively.

Panel (A) Dependent Variables are in levels at time *t Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
TR (-1)	0.556 ***	-1.44***	3.188	-0.098	0.673***	-240.6 ***	-0.683*	0.420**
	(0.005)	(0.000)	(0.533)	(0.923)	(0.000)	(0.000)	(0.082)	(0.021)
FSIZE*(-1)*	0.115 ***	-0.011 ***	-0.353***		0.017 ***	3.12 ***	0.017 *	-0.001
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.096)	(0.130)
LEV*(-1)*	0.072	-0.207***	-0.125	2.52***		26.83***	-0.196	0.002
	(0.199)	(0.000)	(0.924)	(0.000)		(0.000)	(0.325)	(0.816)
AGE*(-1)*	-0.000***	-0.000**	0.022***	0.004***	0.000***		-0.000***	0.000
	(0.000)	(0.049)	(0.001)	(0.000)	(0.000)		(0.000)	(0.443)
MTBV*(-1)*	0.150***	-0.122 ***	0.391	0.148 **	0.012	-7.01 ***		0.025 ***
	(0.000)	(0.000)	(0.250)	(0.048)	(0.168)	(0.000)		(0.000)
CEOWN*(-1)*	-0.256 **	-0.066	2.79 **	-1.00*	0.067	2.01	1.24	
	(0.015)	(0.321)	(0.017)	(0.079)	(0.447)	(0.797)	(0.140)	
R squared	**0.61**	**0.52**	**0.14**	**0.52**	**0.44**	**0.16**	**0.16**	**0.13**
Panel (B) Dependent Variables are in levels at time *t-1* to *t Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
TR (-1)	-0.169	0.033	-36.19*	-0.44*	-0.034	-0.091	0.570	0.038
	(0.130)	(0.512)	(0.074)	(0.057)	(0.639)	(0.153)	(0.426)	(0.745)
FSIZE*(-1)*	0.000	0.001	-0.209		-0.00	0.000	0.002	-0.000
	(0.733)	(0.154)	(0.472)		(0.704)	(0.158)	(0.674)	(0.976)
LEV*(-1)*	0.002	0.000	0.557	0.147***		0.000	-0.049	-0.008
	(0.929)	(0.944)	(0.791)	(0.221)		(0.438)	(0.791)	(0.475)
AGE*(-1)*	-0.000	-0.000	-0.000	-0.00***	-0.000		0.000	0.000
	(0.345)	(0.629)	(0.978)	(0.000)	(0.472)		(0.326)	(0.255)
MTBV*(-1)*	0.000	-0.002	0.834	0.037	0.016**	0.000		0.001
	(0.879)	(0.417)	(0.474)	(0.251)	(0.023)	(0.265)		(0.619)
CEOWN*(-1)*	0.037	0.021	5.29	0.071	0.029	0.012	-0.705**	
	(0.396)	(0.364)	(0.743)	(0.588)	(0.459)	(0.166)	(0.013)	
R squared	0.011	0.014	0.124	0.114	0.036	0.03	0.28	0.024

Table 4.8 Relationship between Board Structure, Firm characteristics, and Past IDO for Financial Sector

This table reports the results of OLS regressions of current board size (BSIZE), non-executive directors (NED), CEO/Chairperson duality (DUL) and current control variables, on past corporate risk and historic values of control variables. Risk is measured by idiosyncratic risk (IDO). The control variables include firm size (FSIZE), leverage (LEV), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). Panel A reports the results of the regressions in which the dependent variables are current levels. Panel B reports the results of the regression in which the dependent variables are the change from t-1 to t. All p-values (in parentheses) are based on robust standard errors. Year and industry dummies are included in all specifications. ***, **, * indicates significance level at the 1%, 5% and 10% respectively.

Panel (A) Dependent Variables are in levels at time *t Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
IDO (-1)	0.367 **	-0.911***	-3.47	-2.022**	0.494***	-120.05***	-0.844**	0.059
	(0.047)	(0.000)	(0.664)	(0.013)	(0.042)	(0.000)	(0.019)	(0.286)
FSIZE*(-1)*	0.119 ***	-0.016 ***	-0.556*		0.018 ***	3.25***	0.035***	0.001
	(0.000)	(0.000)	(0.002)		(0.000)	(0.000)	(0.001)	(0.194)
LEV*(-1)*	0.074	-0.203***	0.538	2.600***		20.84***	0.157	-0.001
	(0.218)	(0.000)	(0.709)	(0.000)		(0.008)	(0.409)	(0.918)
AGE*(-1)*	-0.001***	-0.000	0.021***	0.003***	0.000***		-0.001***	-0.000
	(0.000)	(0.662)	(0.002)	(0.000)	(0.000)		(0.000)	(0.356)
MTBV *(-1)*	0.160***	0.139***	-0.485	0.266***	0.028***	-8.69***		0.006***
	(0.000)	(0.001)	(0.556)	(0.007)	(0.008)	(0.000)		(0.009)
CEOWN*(-1)*	-0.208 *	-0.205	3.098**	0.645	0.148*	-15.50	-0.108	
	(0.066)	(0.133)	(0.022)	(0.587)	(0.095)	(0.103)	(0.787)	
R squared	**0.64**	**0.52**	**0.17**	**0.55**	**0.45**	**0.11**	**0.18**	**0.05**
Panel (B) Dependent Variables are in levels at time *t-1* to *t Financial*								
	BSIZE	NED	DUL	FSIZE	LEV	AGE	MTBV	CEOWN
IDO(-1)	-0.113	0.059	-77.80	-0.596***	0.031	-0.021	-0.405	-0.085
	(0.310)	(0.302)	(0.437)	(0.009)	(0.701)	(0.320)	(0.601)	(0.250)
FSIZE*(-1)*	0.001	0.001	-0.601		-0.001	-0.001	0.005	0.000
	(0.550)	(0.211)	(0.127)		(0.346)	(0.159)	(0.468)	(0.609)
LEV*(-1)*	0.008	0.000	-0.810	-0.140		-0.003	-0.018	-0.017
	(0.779)	(0.979)	(0.745)	(0.322)		(0.216)	(0.930)	(0.203)
AGE*(-1)*	-0.000	-0.000	0.000	-0.000***	-0.000		0.000	0.000
	(0.492)	(0.350)	(0.993)	(0.002)	(0.545)		(0.734)	(0.487)
MTBV*(-1)*	-0.008	-0.003	1.97	0.036	0.022**	0.000		0.002
	(0.297)	(0.287)	(0.214)	(0.431)	(0.015)	(0.346)		(0.264)
CEOWN*(-1)*	-0.005	-0.005	33.35*	-0.155	0.039*	0.000	-0.390	
	(0.918)	(0.774)	(0.058)	(0.157)	(0.099)	(0.892)	(0.137)	
R squared	**0.010**	**0.021**	**0.24**	**0.13**	**0.047**	**0.022**	**0.19**	**0.04**

4.4.3 The Effect of Board Structure on Current Corporate Risk Taking

This section investigates how the board structure characteristics are related to the corporate risk taking. The analysis first takes place in the non-financial sector and then moves to the financial sector. This enables us to highlight the similarities and differences between the two sectors. Following Wintoki et al. (2012), the study uses a dynamic model to control for the endogeneity that was explained in the previous sections. In addition, this dynamic model includes the lagged dependent variables as explanatory variables in the right hand side of the equations.

As indicated in Table 4.4, the first and the second lags of total risk are significant; therefore, they will be included in the model as explanatory variables when the dependent variable is total risk. Further, this makes lag three and greater available to be used as instruments for total risk. Regarding the second proxy of risk, i.e. idiosyncratic risk, Table 4.4 indicates that including one lag in the model will be sufficient. Consequently, this study uses lag two and older as instruments for idiosyncratic risk. In addition, system GMM uses the lagged values of dependent variables and explanatory variables as instruments to control for endogeneity. For all the endogenous variables this study uses lag two and all the older lags as instruments. The following models are used to examine these relationships:

$$TR_{it} = \alpha_1 + k_1 TR_{it-1} + k_1 TR_{it-2} + \beta BOD_{it} + \gamma Control_{it} + \theta X_{it} + \mu_i + \varepsilon_{it} \qquad (4.4)$$

$$IDO_{it} = \alpha_1 + k_1 IDO_{it-1} + \beta BOD_{it} + \gamma Control_{it} + \theta X_{it} + \mu_i + \varepsilon_{it} \qquad (4.5)$$

Where TR is total risk, TR_{it-1}, TR_{it-2} is the first and the second lag of total risk, BOD is the board structure variables (board size, independence and CEO/Chairperson duality), Control is the control variables including leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). X_{it} is the exogenous variables including firm age, and year dummies. In the second model, all the definitions are the same except that IDO_{it} is the idiosyncratic risk and IDO_{it-1} is the first lag of idiosyncratic risk.

Table 4.9 presents the estimates of models (4.4) and (4.5) for the non-financial sector, while Table 4.10 reports the results for the financial sector. However, for both sectors, this study reports the main results using OLS and system GMM estimates to show how the results change if we ignore the dynamic endogeneity in the model. In addition, it is important to note that in the OLS model this study includes dummies to control for industry effect and years. Panel (A) in Table 4.9 reports the results using total risk as a dependent variable. Static OLS estimate in Table 4.9 suggests an insignificant relationship between board size and total risk. Under system GMM the sign flips to negative but the coefficient on board size is still insignificant. This result indicates that, after controlling for the past effect of corporate risk, board size has no impact on corporate total risk under total risk.

Panel (B) in Table 4.9 reports an insignificant effect between board size and idiosyncratic risk under static OLS. Prior studies that apply OLS report similar insignificant results (Lewellyn and Muller-Kahle 2012; Tao and Hutchinson 2013). However, using the dynamic estimator system GMM, the results indicate a negative and significant relationship between board size and idiosyncratic risk where the p-value is (0.062). As explained in previous chapters, the interest of this study is in the idiosyncratic risk since it is highly affected by the directors' decisions. This negative effect suggests that larger boards lower idiosyncratic risk of the firm. According to this result, ***H1,*** which states a negative relationship between board size and corporate risk, is accepted for the non-financial sector. This negative effect is in line with the agency theory assumptions where larger boards suffer more from communication and coordination problems which in turn slow down the decision-making process (Jensen 1993).

In addition, this negative effect is consistent with the arguments of economics and social psychology studies (Kogan and Wallach 1964; Moscovici and Zavalloni 1969; Sah and Stiglitz 1991). According to these studies, it is difficult to reach a consensus in large groups and extreme decisions are usually rejected. The results with respect to the negative effect of board size are consistent with the US evidence (e.g., Cheng 2008; Kim and Buchanan 2008; Minton et al. 2014; Pathan 2009; Wang 2012), that from China (Chen 2011), Japan (Nakano and Nguyen 2012) and New Zealand (Koerniadi et

al. 2014), and are also consistent with a recent paper from the UK (McNulty et al. 2013).

Table 4.10 suggests that under the total risk and idiosyncratic risk both OLS and system GMM report an insignificant relationship between board size and corporate risk measures in the financial sector. Therefore, ***H1*** is rejected for the financial sector. This insignificant effect may be attributed to the large size of the board in the financial sector. Compared to the non-financial firms, most of the financial firms have larger boards. For example, the average number of directors in banks, insurance companies, real estate, and financial services companies is 14.39, 10.5, 7.74 and 6.3 respectively, where the maximum number of directors on the boards of non-financial firms is 9.52. Jensen (1993) argues that when the number of directors is greater than seven or eight the board of directors is no more effective in performing their roles and duties.

Another reason may be related to the heavy regulation in the financial sector. These tight regulations may require a certain level of risk taking in the financial institutions due to the consequences of these decisions not only on the firm itself but also on other related parties such as depositors, debtholders and other institutions in the market. Thus, it is expected that, whatever the board size is, the level of risk taking should be consistent with the firm policy in order to satisfy these intense regulations. Therefore, under these restrictions the effect of board size is limited in the financial sector. In addition, the insignificant effect is possibly related to the number of financial firms included in the sample. The sample from the financial sector includes only 276 firms while the non-financial sector includes 589 firms. As the analysis has fewer financial firms, this may lead to the insignificant relationship compared with the non-financial sector. These results are consistent with prior studies that examine the financial sector. For example, Lewellyn and Muller-Kahle (2012) study all the US financial firms that are specialised in subprime lending. The authors report an insignificant relationship between board size and risk taking. Likewise, Tao and Hutchinson (2013) examine all the financial institutions in the Australian financial sector and find an insignificant effect between board size and corporate risk taking.

Table 4.9 suggests a positive and significant relationship between board independence and total risk under the OLS estimate. This positive result provides support for the

agency theory which assumes that the non-executive directors work as effective monitors for managerial actions and represents shareholders' rights (Eisenhardt 1989; Jensen and Meckling 1976). However, when the model is estimated via system GMM the relationship is no more significant. The change in the results between OLS and system GMM could be attributed to the presence of endogeneity in the model. As discussed before, OLS is unable to control for endogeneity especially the dynamic one. Thus it is expected that the results obtained from OLS are not consistent and are biased (Baixauli-Soler et al. 2014). Further, Wintoki et al. (2012) argue that the change in the coefficient signs between static OLS and dynamic GMM results from the limitation of the static model to capture the dynamic endogeneity in the model.

Panel (B) in Table 4.9 reports a positive and significant relationship between board independence and idiosyncratic risk. This positive relationship appears when the model is estimated by OLS. This positive effect suggests that adding more non-executive directors to the board increases the idiosyncratic risk of the firm. This positive effect is consistent with Minton et al. (2014), who report similar results using OLS. In contrast, the dynamic panel estimator system GMM suggests that the causality is reversed. The dynamic estimation indicates a negative and a significant relationship between board independence and idiosyncratic risk. This is consistent with the results reported in Tables 4.7 and 4.8. Firms that took lower risk in the past increase the number of current non-executive directors on their boards. Accordingly, ***H2***, which states a negative relationship between board independence and corporate risk, is accepted for the non-financial sector.

The reputation hypothesis, according to Fama and Jensen (1983b), suggests that independent directors work hard to protect their human capital in the market. The value of independent directors depends in the first place on their reputation as experts in decision control. Consequently, they try to reflect this positive impact to the external market and through their multiple directorships. The negative relationship that is obtained in our results may be explained within the reputation context. Independent directors may work in a way to avoid risky decisions that may not only – in some cases – lead to reduction in firm value but also increase insolvency risk.

In addition, the negative and significant effect of non-executive directors is consistent with the monitoring hypothesis. The role of non-executives is less effective as information asymmetry increases (Prendergast 2000; Raheja 2005). The non-executive directors are less informed since they lack certain details and specific information that are available to firm executives. The high cost of obtaining such information makes it difficult for the non-executives to properly evaluate the investment decisions. Accordingly, the presence of non-executive directors on the board negatively affects corporate risk taking (Boone et al. 2007; Coles et al. 2008; Harris and Raviv 2008; Linck et al. 2008; Prendergast 2000; Raheja 2005). Moreover, the results with respect to board independence are consistent with the arguments of Cheng (2008), who claims that the non-executive directors who have different backgrounds and heterogeneous opinions moderate board decisions and eventually lower corporate risk taking.

Table 4.10 reports similar results on the effect of non-executive directors on corporate risk. Under both estimation methods, i.e. OLS and system GMM, the coefficient on board independence is negative and significant. The p-value under the total risk is (0.081) and under the idiosyncratic risk it is (0.001). A noticeable difference in Table 4.10 is that the coefficient on non-executive directors in the financial sector is highly significant compared with the coefficient in the non-financial sector. This is also consistent with the argument that in the financial sector there is greater information asymmetry which limits the effectiveness of non-executives in evaluating investment decisions (Macey and O'Hara 2003). In addition, these results are consistent with Pathan (2009), who covers the largest bank holding companies in the US; the author points out that the heavy regulation and continuous monitoring from regulators in the financial sector may force the directors – including independent ones – to be more conservative.

Our result regarding board independence is also consistent with Brick and Chidambaran (2008), who employ 4162 observations from the US non-financial sector. The authors show that board independence, which is measured in two different ways as the proportion and the number of non-executives, is negatively related to corporate risk. The negative effect is also consistent with Gonzalez and André (2014), who report that having more non-executive directors on UK boards is associated with lower short-term risk in the non-financial firms.

Table 4.9 The Effect of Board Structure on Corporate Risk Taking in the Non-Financial Sector

This table presents the results of static pooled OLS and dynamic system GMM using total risk and idiosyncratic risk as proxies for corporate risk. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

	Panel (A) Total Risk		***Panel (B) Idiosyncratic Risk***	
Dependent Variable	***Static Pooled OLS***	***System GMM***	***Static Pooled OLS***	***System GMM***
ln (BSize)	0.000	-0.005	-0.003	-0.059*
	(0.824)	(0.390)	(0.424)	(0.062)
NED	0.027***	0.007	0.030**	-0.117*
	(0.000)	(0.648)	(0.035)	(0.071)
DUL	0.004	-0.009*	-0.002	-0.049**
	(0.372)	(0.100)	(0.655)	(0.047)
LEV	0.029***	0.052***	0.054***	0.133***
	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.000***	-0.000**	-0.000***	-0.000*
	(0.000)	(0.042)	(0.000)	(0.080)
MTBV	-0.015***	-0.007***	-0.019***	-0.026***
	(0.000)	(0.000)	(0.000)	(0.001)
CEOWN	-0.008	0.055***	-0.018	0.044
	(0.649)	(0.007)	(0.578)	(0.619)
FSize	-0.012***	-0.005***	-0.014***	-0.025***
	(0.000)	(0.000)	(0.000)	(0.000)
$TotalRisk_{(t-1)}$		1.059***		0.166*
		(0.000)		(0.059)
$TotalRisk_{(t-2)}$		-0.233***		
		(0.000)		
Constant	0.302***	0.016	0.257***	0.592***
	(0.000)	(0.128)	(0.000)	(0.000)
R^2	***0.35***		***0.17***	
AR(1) test (p-value)		0.000		0.000
AR(2) test (p-value)		0.492		0.715
Hansen test of over-identification (p-value)		0.533		0.470
Diff-in-Hansen tests of exogeneity (p-value)		0.687		0.457

Table 4.9 shows that the CEO/Chairperson duality has no significant effect on corporate risk taking in the non-financial sector under the OLS estimation. This insignificant relationship suggests that combining or separating the two roles will not affect corporate risk. Some previous papers report a similar insignificant relationship (Berger et al. 2014; Chen 2011; Cheng 2008; McNulty et al. 2013). However, after controlling for the three types of endogeneity, system GMM indicates a negative and significant relationship between CEO/Chairperson duality and both risk measures, i.e. total risk and idiosyncratic risk, in the non-financial sector. The analysis yields a p-value of (0.100) and (0.047) for total risk and idiosyncratic risk respectively.

The results in the financial sector for the CEO/Chairperson duality indicate a negative and significant relationship under the idiosyncratic risk only, where the p-value is (0.016). The dynamic panel estimator system GMM suggests that combining the two roles reduces the idiosyncratic risk. Nevertheless, under the total risk the relationship is insignificant using either OLS or system GMM. The negative relationship between CEO/Chairperson duality implies that managers who hold the CEO and chairperson positions at the same time tend to choose less risky decisions. This finding leads us to accept ***H3*** for both sectors under the idiosyncratic risk; ***H3*** states that there is a negative relationship between CEO/Chairperson duality and corporate risk taking. This negative effect has also been reported by prior US studies (Kim and Buchanan 2008; Pathan 2009).

These findings are theoretically consistent with the agency theory arguments. Within the agency theory context, both the manager (agent) and the owner have different risk preferences (Baysinger and Hoskisson 1990; Baysinger and Butler 1985; Eisenhardt 1989; Jensen and Meckling 1976). Managers tend to be more risk averse because they are unable to diversify their own human capital (Amihud and Lev 1981; May 1995; Smith and Stulz 1985; Tufano 1996). In addition, managers are more concerned about the possible negative effect of risky decisions such as reduction in firm value or insolvency risk as this threatens their employment and reputation in the market (Baysinger and Hoskisson 1990; Eisenhardt 1989; Fama 1980). Moreover, the corporate governance literature highlights the possible negative effect of combining both positions (Jensen 1993; Lipton and Lorsch 1992). Increasing power concentration

in the hands of the CEO facilitates opportunistic managerial behaviour. Accordingly, too much power in the CEO's hands reduces the effectiveness of board monitoring functions as well (Jensen 1993). It is noticeable that for board independence and CEO/Chairperson duality the significance level increased from 10% level when total risk is used to 5% and 1% when idiosyncratic risk is the dependent variable. This provides evidence that idiosyncratic risk is more influenced by the board of directors' decisions and this is consistent with our earlier assumptions.

Table 4.10 The Effect of Board Structure on Corporate Risk Taking in the Financial Sector

This table presents the results of static pooled OLS and dynamic system GMM using total risk and idiosyncratic risk as proxies for corporate risk. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

	Panel (A) Total Risk		***Panel (B) Idiosyncratic Risk***	
Dependent Variable	***Static Pooled OLS***	***System GMM***	***Static Pooled OLS***	***System GMM***
ln (BSize)	0.001	0.001	0.005	-0.000
	(0.759)	(0.835)	(0.450)	(0.996)
NED	-0.063***	-0.010*	-0.069***	-0.083***
	(0.000)	(0.081)	(0.000)	(0.001)
DUL	-0.005	-0.001	-0.027***	-0.030**
	(0.401)	(0.687)	(0.000)	(0.016)
LEV	0.040***	0 .017*	0.040***	0 .014
	(0.000)	(0.052)	(0.001)	(0.595)
Age	-0.000***	-0.000***	-0.000***	-0.000**
	(0.000)	(0.009)	(0.000)	(0.022)
MTBV	-0.007***	-0.006***	-0.013***	-0.015**
	(0.000)	(0.007)	(0.007)	(0.040)
CEOWN	0.110***	0.006	0.125***	0.060
	(0.000)	(0.466)	(0.000)	(0.471)
FSize	-0.000	0.000	-0.003***	-0.002
	(0.317)	(0.651)	(0.001)	(0.358)
$TotalRisk_{(t-1)}$		1.203***		0.274***
		(0.000)		(0.000)
$TotalRisk_{(t-2)}$		-0.332***		
		(0.000)		
Constant	0.154***	0.112	0.135***	0.115***
	(0.000)	(0.134)	(0.000)	(0.006)
R^2	***0.31***		***0.22***	
AR(1) test (p-value)		0.000		0.000
AR(2) test (p-value)		0.335		0.455
Hansen test of over-identification (p-value)		0.130		0.227
Diff-in-Hansen tests of exogeneity (p-value)		0.438		0.268

Both Tables 4.9 and 4.10 show that the lags of risk-taking measures are significant. This implies that past corporate risk taking explains and determines the current risk-taking level and board structure variables. Further, it also implies that ignoring the effect of past corporate risk in the estimation means that our model is miss-specified. Regarding control variables, in both sectors we can find a positive and significant relationship between leverage and both risk measures. Only in the financial sector under the idiosyncratic risk does the dynamic panel estimator report that leverage is insignificant. This positive relationship is common in the literature, where firms with higher leverage are exposed to higher risk. Although it could reduce free cash flow and serve as a governance mechanism that limits managerial discretion, firms with higher leverage have a higher chance of bankruptcy risk. Previous studies have found similar results (Adams et al. 2005; Erkens et al. 2012; Nakano and Nguyen 2012).

Tables 4.9 and 4.10 also report a negative significant relationship between growth opportunity and both risk measures, although based on previous literature we expect a positive relationship; that is, firms with more growth opportunity have higher risk (Akhigbe and Martin 2008). However, it may be argued that the causality is reversed for this variable due to the endogeneity in our model. Firms with high growth opportunities have taken higher risk in the past. However, these firms may decide to choose less risky choices now, so they avoid exposing the firm to more high volatility. Moreover, this is consistent with the results obtained in both Tables 4.7 and 4.8 where MTBV is negatively related to the past risk measures, which confirm that firms that took higher risk in the past avoid the current growth opportunities. This negative and significant relationship is consistent with the findings of Hagendorff and Vallascas (2011).

In both the non-financial and financial sectors the results report a negative and significant relationship between firm age and both risk measures. These findings imply that older firms have lower risk. As firms grow and have more experience and they become more able to handle and control risk. These results are consistent with Lewellyn and Muller-Kahle (2012) and Adams et al. (2005), who report similar findings.

The coefficient on firm size is negative and significant where the p-value is (0.000) in the non-financial sector; however, firm size has no significant effect in the financial sector. The negative relationship confirms that larger firms have lower risk because they are more able to diversify risk. Larger firms have quick and greater access to the capital market. Moreover, those large firms can deal with unpredicted liquidity problems in a more effective and flexible way than smaller firms can (Konishi and Yasuda 2004). This result is in line with previous research papers that have documented similar correlations between firm size and risk (Adams et al. 2005; Anderson and Fraser 2000; Cheng 2008; Kim and Buchanan 2008; Konishi and Yasuda 2004; Nakano and Nguyen 2012).

Table 4.9 indicates that the CEO ownership has no significant effect on either total risk or idiosyncratic risk under the OLS estimation. However, the dynamic panel estimator reports a positive and significant coefficient between CEO ownership and total risk only, where the p-value is (0.007). However, under the idiosyncratic risk the coefficient is insignificant. The positive relationship is consistent with the alignment hypothesis. Providing managers with more shares aligns their interest with firm's shareholders (Jensen and Meckling 1976). Adams et al. (2005) report a positive and significant relationship between CEO ownership and total risk. Nevertheless, consistent with our results, the authors report an insignificant relationship between CEO ownership and the standard deviation of both Tobin's Q and ROA. In the financial sector, under both risk measures the OLS estimates suggest a positive and significant relationship between CEO ownership and risk measures. In contrast, system GMM reports an insignificant relationship under both risk measures.

The results in both Tables 4.9 and 4.10 show that all the specification tests, i.e. the first and second serial correlation in the first differenced residuals, Hansen test and differences in Hansen test, are passed. Wintoki et al. (2012, p.15) argue that, in the serial correlation tests (AR(1)) and (AR (2)), the serial correlation exists in the first difference (AR (1)). However, no serial correlation should be detected in second differences (AR (2)). The results in both tables are consistent with these arguments. The *p-value* of (AR (2)) under total risk (idiosyncratic risk) is 0.492 (0.715) for the non-financial sector and 0.335(0.455) for the financial sector, which means there is no serial correlation and the null hypothesis is accepted. Additionally, the *p-value* of Hansen test

under total risk (idiosyncratic risk) is 0.533(0.470) for the non-financial sector and 0.130(0.227) for the financial sector. Thus, the null hypothesis that states our instruments are valid is accepted.

System GMM assumes that any correlation between endogenous variables and unobserved effect is constant over time (Wintoki et al. 2012). This assumption makes it possible to include level equations and use lagged differences as instruments for these levels. The differences in Hansen test provide the results for this assumption (Bond et al. 2001). The p-value under total risk (idiosyncratic risk) is 0.687(0.457) for the non-financial sector and 0.438(0.268) for the financial sector. These values suggest that the null hypothesis, which states that the instruments used in level equations are exogenous, is accepted.

4.5 Robustness Checks

This section provides several tests which aim to support the main results obtained in the previous section. As indicated in the above discussion, the main concern in estimating our model is the endogenous relationship between the board structure variables, firm financial characteristics and past corporate risk taking. However, the estimation method that is applied in the empirical analysis provides several advantages over the traditional estimation method. The dynamic panel estimator system GMM controls for all the sources of the endogeneity that may arise in the model. Even then, this section provides additional sensitivity tests to make sure that our results are robust.

Market-Adjusted Risk Measures

In the first test, this study re-estimates models (4.4) and (4.5) after adjusting the risk measures by market. Thus, the market-adjusted risk measures ensure that our results are not driven by market effect. Given that corporate risk taking is influenced by market forces, thus we exclude the effect of these variables by adjusting the risk measures (Lenard et al. 2014). Following Cheng (2008) and Lenard et al. (2014), this study uses the standard deviation of market-adjusted return in order to exclude the market factors effect on corporate performance variability. To calculate adjusted risk measures, this stud subtracts the monthly return on the FTSE All-Share Index from the monthly return

for each firm. After adjusting the monthly stock returns, the study calculates the standard deviation of market-adjusted return for total risk and the standard deviation of residuals from the Fama and French model for idiosyncratic risk. Table 4.11 reports the results for both the non-financial and financial sectors. The results in Table 4.11 are similar to the results that are obtained from Tables 4.9 and 4.10.

In the non-financial sector, the coefficient on the CEO/Chairperson duality is negative and significant under the total risk. The board size, board independence and CEO/Chairperson duality remain negative and significant under the idiosyncratic risk. These results are similar to those reported in Table 4.9. In the financial sector, Table 4.11 shows that the board independence remains negative and significant after adjusting both risk measures to the market. Under the total risk the coefficient on board independence is still negative and significant with a p-value (0.018). These results are similar to those obtained from Table 4.10. Taken together, the results in Table 4.11 confirm the robustness of our results after adjusting both risk measures to the market.

Table 4.11 The Effect of Board Structure on Market-Adjusted Risk Measures

This table reports the results of dynamic system GMM for estimating models (4.4) and (4.5) after adjusting risk measures to the industry. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***Non-Financial***		***Financial***	
	Idiosyncratic Risk	***Total Risk***	***Idiosyncratic Risk***	***Total Risk***
ln (BSize)	-0.043*	-0.002	0.027	0.005
	(0.061)	(0.387)	(0.228)	(0.241)
NED	- 0.115*	0.003	-0.102***	-0.014**
	(0.075)	(0.803)	(0.000)	(0.018)
DUL	- 0.031**	- 0.010*	-0.064***	-0.005
	(0.047)	(0.094)	(0.002)	(0.316)
Age	-0.000*	-0.005**	-0.000*	-0.000***
	(0.086)	(0.038)	(0.064)	(0.003)
LEV	0.134***	0.050***	0.001	0.017**
	(0.008)	(0.000)	(0.962)	(0.031)
MTBV	-0.026***	-0.009***	-0.016*	-0.007***
	(0.001)	(0.000)	(0.078)	(0.007)
CEOWN	0.045	0.058***	0.166**	0.004
	(0.690)	(0.008)	(0.050)	(0.441)
FSize	-0.024***	-0.005***	-0.005	0.000
	(0.000)	(0.000)	(0.240)	(0.719)
$Risk_{(t-1)}$	0.167*	1.055***	0.141***	1.172***
	(0.055)	(0.000)	(0.000)	(0.000)
$Risk_{(t-2)}$		-0.227***		-0.293***
		(0.000)		(0.000)
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.711	0.533	0.420	0.255
Hansen test of over-identification (p-value)	0.484	0.490	0.261	0.040
Diff-in-Hansen tests of exogeneity (p-value)	0.610	0.130	0.516	0.460

Controlling for the Risk Committee

Risk committees may play important roles in the decision-making process and particularly in those decisions related to corporate risk. The existence of such committees may provide several advantages. Board committees meet more frequently and independently from the full board (Klein 2002) . In addition, these committees have a specific, clear and limited function to perform (Jiraporn et al. 2009; Kesner 1988). These characteristics make them attractive to be initiated especially in large corporations where board members have to carry out a huge amount of activities (Harrison 1987). Kesner (1988) argues that most of the critical decisions are taken by the sub-committees not the full board. Further, the composition of these committees is usually of the independent directors, who meet several attractive features such as expertise, specialisation and independence from management (Kesner 1988). Therefore, it is expected that these committees influence the important strategies of the firm.

Using the BoardEx database, risk committee is measured by a dummy variable equal to one if the firm has a risk committee and zero otherwise. This study re-estimates models (4.4) and (4.5) and includes the risk committee as a control variable. Table 4.12 reports the results for the non-financial and financial sectors. Table 4.12 shows that the results remain similar to those obtained from Tables 4.9 and 4.10. It is noticeable from Table 4.12 that the coefficient on risk committee is positive and significant in both sectors. This implies that the existence of a risk committee enhances taking more risky decisions and therefore it works in line with shareholders' interests. Further, another interesting point that we can infer from Table 4.12 is that the coefficient on risk committee is only significant under idiosyncratic risk. This may reveal and indicate that idiosyncratic risk is more relevant and more influenced by the structure of the board. Accordingly, this enhances our focus on this risk component in this study.

Table 4.12 The Effect of Board Structure on Corporate Risk Measures Including Risk Committee

This table reports the results of dynamic system GMM for estimating model (4.4) and (4.5) after including risk committee. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***Non-Financial***		***Financial***	
	Idiosyncratic Risk	***Total Risk***	***Idiosyncratic Risk***	***Total Risk***
ln (BSize)	-0.057**	-0.005	-0.001	0.004
	(0.044)	(0.335)	(0.923)	(0.388)
NED	-0.099*	0.006	-0.079***	-0.013**
	(0.078)	(0.713)	(0.000)	(0.012)
DUL	- 0.049**	- 0.010*	-0.028**	-0.001
	(0.047)	(0.069)	(0.021)	(0.715)
LEV	0.108**	0.051***	0.023	0.018**
	(0.023)	(0.000)	(0.239)	(0.025)
Age	-0.000**	-0.000*	-0.000**	-0.000***
	(0.023)	(0.072)	(0.021)	(0.000)
MTBV	-0.029***	-0.007***	-0.015**	-0.007***
	(0.000)	(0.000)	(0.046)	(0.003)
CEOWN	0.045	0.053***	0.042	0.007
	(0.616)	(0.009)	(0.629)	(0.363)
FSize	-0.025***	-0.005***	-0.004	0.000
	(0.000)	(0.000)	(0.149)	(0.866)
RC	0.029*	0.003	0.017*	0.002
	(0.061)	(0.411)	(0.096)	(0.311)
$Risk_{(t-1)}$	0.165**	1.071***	0.266***	1.178***
	(0.048)	(0.000)	(0.000)	(0.000)
$Risk_{(t-2)}$		-0.243***		-0.316***
		(0.000)		(0.000)
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.720	0.435	0.420	0.335
Hansen test of over-identification (p-value)	0.533	0.584	0.538	0.111
Diff-in-Hansen tests of exogeneity (p-value)	0.672	0.669	0.400	0.734

An Alternative Accounting Risk Measure

The main results of this study in section 4.3 are obtained by measuring the corporate risk taking with two market risk measures. In the methodology chapter, the reasons behind using market measures are explained. However, to check for the results, this study employs an accounting risk measure, which is Z-score. This measure shows how far the firm is from insolvency (Roy 1952). In addition, the higher the value of Z-score indicates that the firm is more stable. Following Vyas (2011), Laeven and Levine (2009) and Houston et al. (2010), the Z-score is calculated according to the following equation: Z-score=(ROA+CAR)/σ (ROA), where ROA is the return on assets, CAR is the capital asset ratio, and σ (ROA) is the standard deviation of return on assets. The sample study was used over five years to estimate these values. To make this risk measure comparable to the others, this study uses 1/Z-score, which represents insolvency risk. The results of insolvency risk are reported in Table 4.13 for both non-financial and financial sectors. The results in Table 4.13 are consistent with our results in the previous section.

Additional Sensitivity Tests in Terms of Endogenous/Exogenous Specification

The main results that are obtained in section 4.3 are based on the assumption that all the board structure variables and all the firm characteristics are endogenous except firm age and year dummies (Wintoki et al. 2012). In their study, Wintoki et al. (2012) find that firm age is significantly related to past performance, even though they consider this variable to be particularly exogenous. This logically makes sense, because whatever is the firm outcome it is expected not to be affected by firm age. Similarly, the board structure is expected not to be adjusted according to firm's age. Our results in Tables 4.7 and 4.8 are similar where the firm age is significantly related to the past corporate risk and, following Wintoki et al. (2012), this study considers it to be exogenous.

Table 4.13 The Effect of Board Structure on Corporate Risk using Z-score

This table reports the results of dynamic system GMM for estimating models (4.4) and (4.5) using Z-score as a dependent variable. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

(1/Z-score)	***Non-Financial Sector***	***Financial Sector***
ln (BSize)	-0.072** (0.043)	-0.057 (0.821)
NED	-0.217* (0.095)	-0.078* (0.091)
DUL	- 0.070* (0.084)	- 0.024** (0.015)
LEV	0.438** (0.018)	0.028* (0.075)
Age	-0.005* (0.059)	-0.001** (0.013)
MTBV	0.050 (0.720)	-0.015** (0.041)
CEOWN	0.524* (0.090)	-0.044** (0.029)
FSize	0.017** (0.026)	0.009 (0.128)
$ZRisk_{(t-1)}$	0.651*** (0.000)	0.272*** (0.000)
$ZRisk_{(t-2)}$	- 0.247** (0.038)	-0.358** (0.038)
AR(1) test (p-value)	0.228	0.000
AR(2) test (p-value)	0.330	0.860
Hansen test of over-identification (p-value)	0.406	0.239
Diff-in-Hansen tests of exogeneity (p-value)	0.881	0.938

In the final test in this section, this study re-estimates models 4.4 and 4.5 assuming that all the variables are endogenous, even the firm age. Table 4.14 reports the results for the non-financial sector. In panel (A), all the variables in the model are considered endogenous except year dummies. Table 4.14 shows that the results are similar to those obtained in the previous section. However, only the Hansen test for instruments validity did not pass. This may reveal that our previous specification yields better results when the firm age is treated as exogenous

Under panel (B) in Table 4.14, we re-estimate models 4.4 and 4.5 assuming that the board structure variables are exogenous. In the non-financial sector, the board structure variables are not related to past corporate risk (see Tables 4.5 and 4.6). However, the results provide evidence that all the board structure variables are related to most of the past control variables. The results in Table 4.14 change totally and the board structure variables, board size and CEO/Chairperson duality are no more significant. Additionally, the coefficient on board independence turns out to be positive under the idiosyncratic risk. Moreover, the Hansen test for instruments validity and the differences in Hansen test did not pass. These results suggest that our specifications in the previous section provide better results when all the specification tests are passed.

For the financial sector, this study re-estimates models 4.4 and 4.5 assuming all the variables are endogenous except year dummies. Panel (A) in Table 4.15 reports the results under this assumption. The results in Table 4.15 in panel (A) are similar to those obtained in the previous section for the financial sector except Hansen test for instruments validity under both risk measures was not passed. In panel (B), we re-estimate models 4.4 and 4.5 assuming that only the variables that are significantly related to the past corporate risk are endogenous; otherwise the variables are considered exogenous. Based on the results in Tables 4.7 and 4.8, this assumption leads us to consider that CEO/Chairperson duality, firm size, and MTBV are exogenous under the total risk. However, only CEO/Chairperson duality and CEO ownership are exogenous under the idiosyncratic risk.

Table 4.14 The Effect of Board Structure on Corporate Risk with Different Specifications for Non-Financial Sector

This table reports the results of dynamic system GMM for estimating models (4.4) and (4.5) with different specifications. Panel (A) assumes that all the variables in the model are endogenous except year dummies. Panel (B) assumes that the board structure variables are exogenous. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	**(A)**		**(B)**	
	Total Risk	***Idiosyncratic Risk***	***Total Risk***	***Idiosyncratic Risk***
ln (BSize)	0.001	-0.003*	-0.009	0.009
	(0.835)	(0.096)	(0.201)	0.136
NED	-0.010*	-0.083***	0.001	0.076***
	(0.081)	(0.001)	(0.744)	(0.000)
DUL	-0.001	-0.030**	-0.004	-0.014
	(0.687)	(0.016)	(0.183)	(0.226)
LEV	0 .017*	0.014	0 .05***	0.123***
	(0.052)	(0.595)	(0.000)	(0.000)
Age	-0.009***	-0.000**	-0.000***	-0.000
	(0.000)	(0.022)	(0.008)	(0.347)
MTBV	-0.006***	-0.015**	-0.006***	-0.028***
	(0.007)	(0.040)	(0.000)	(0.000)
CEOWN	0.006	0.060	0.061***	0.049
	(0.466)	(0.471)	(0.001)	(0.469)
FSize	0.000	-0.002*	-0.002***	-0.027***
	(0.651)	(0.058)	(0.000)	(0.000)
$Risk_{(t-1)}$	1.203***	0.274***	1.118***	0.177***
	(0.000)	(0.000)	(0.000)	(0.000)
$Risk_{(t-2)}$	-0.332***		-0.248***	
	(0.000)		(0.000)	
Constant	0.016	0.115***	0.093**	0.354***
	(0.128)	(0.000)	(0.015)	(0.000)
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.335	0.455	0.532	0.640
Hansen test of over-identification (p-value)	0.030	0.227	0.000	0.000
Diff-in-Hansen tests of exogeneity (p-value)	0.438	0.268	0.014	0.001

Table 4.15 The Effect of Board Structure on Corporate Risk with Different Specifications for Financial Sector

This table reports the results of dynamic system GMM for estimating models (4.4) and (4.5) with different specifications. Panel (A) assumes that all the variables in the model are endogenous except year dummies. Panel (B) assumes that all the variables are endogenous except, FSize, DUL and CEOWN under idiosyncratic risk. Under total risk Panel (B) suggests that all the variables are endogenous except FSize, DUL and MTBV. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	**(A)**		**(B)**	
	Total Risk	***Idiosyncratic Risk***	***Total Risk***	***Idiosyncratic Risk***
ln (BSize)	-0.005	-0.063	-0.000	-0.013
	(0.341)	(0.123)	(0.950)	(0.555)
NED	0.013	-0.011**	-0.012**	-0.076***
	(0.354)	(0.042)	(0.037)	(0.006)
DUL	-0.011*	-0.083***	-0.002	-0.026***
	(0.059)	(0.000)	(0.187)	(0.002)
LEV	0 .059***	0.124***	0.019	0.028
	(0.000)	(0.000)	(0.187)	(0.414)
Age	-0.000**	-0.000	-0.000	-0.000*
	(0.020)	(0.309)	(0.154)	(0.072)
MTBV	-0.006***	-0.019***	-0. 005**	-0.007
	(0.000)	(0.001)	(0.030)	(0.267)
CEOWN	0.060***	0.063	0.005	0.041
	(0.001)	(0.369)	(0.482)	(0.587)
FSize	-0.004*	-0.003	0.000	0.000
	(0.072)	(0.111)	(0.793)	(0.903)
$Risk_{(t-1)}$	1.078***	0.171***	1.221***	0.265***
	(0.000)	(0.001)	(0.000)	(0.000)
$Risk_{(t-2)}$	-0.230***		-0.351***	
	(0.000)		(0.000)	
Constant	0.094**	0.570***	0.021**	0.103**
	(0.017)	(0.000)	(0.029)	(0.042)
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.606	0.525	0.319	0.340
Hansen test of over-identification (p-value)	0.000	0.000	0.012	0.098
Diff-in-Hansen tests of exogeneity (p-value)	0.060	0.401	0.205	0.704

Panel (B) in Table 4.15 provides consistent and similar results to those obtained in the previous section in the financial sector. However, the Hansen test under both risk measures was not passed. Taken together, the results in Tables 4.14 and 4.15 provide evidence that our specifications in the main analysis provide more valid and consistent findings since all the specification tests were passed.

4.6 Summary

Corporate governance mechanisms aim to mitigate the agency conflicts between management and shareholders in modern corporations. One of these mechanisms is the board of directors, which is considered to be the main internal governance tool in the corporations (Fama and Jensen 1983b). Agency theory emphasises that the effectiveness of the board mainly depends on its structure. The board size, independence and CEO/Chairperson duality determine the structure of the board of directors (Adams et al. 2010; Hermalin and Weisbach 2003). Therefore, it is important to examine how the structure of the board affects firm's outcomes. More specifically, this study examines how the board size, independence and CEO/Chairperson duality affect corporate risk taking. This study examines these relationships in all the UK public listed companies in both non-financial and financial sectors over the period 2003-2012.

To conduct this analysis, this study employs a dynamic panel estimator system GMM. Throughout the analysis, the study provides empirical evidence that the board structure variables are endogenously determined. The choice of this estimation method, i.e. system GMM, in particular is to control for the dynamic endogeneity in the model. That is, past corporate risk determines current values of corporate risk taking, board structure and firm financial characteristics. This type of endogeneity is usually ignored in most corporate governance studies. Further, traditional methods fail to properly deal with such problems. However, system GMM uses the lags of dependent and explanatory variables as instruments for the endogenous variables (Wintoki et al. 2012). Moreover, applying this technique controls for simultaneity and unobservable heterogeneity as well.

In the main analysis, this study reports the results using OLS estimation in order to indicate how the result may be biased if the dynamic endogeneity in the model is ignored. The empirical results provide evidence that the effect of board structure in the non-financial sector differs from that in regulated industries. The main results in the non-financial sector show that the board size is negative and significant under the idiosyncratic risk but not under the total risks. This result suggests that larger boards lower corporate risk taking. This is consistent with the arguments in the economics and

social psychology studies. In larger groups, it is difficult to reach an agreement and the final decision represents a compromise that reveals all these differences and, therefore, high-risk projects are usually rejected (Kogan and Wallach 1964; Moscovici and Zavalloni 1969; Sah and Stiglitz 1991). Moreover, the negative effect provides support for the agency theory predictions where larger boards suffer from communication and coordination problems and thus it is difficult to reach a consensus (Jensen 1993; Lipton and Lorsch 1992).

In contrast, in the financial sector, the board size has no impact on corporate risk taking under either risk measure. The insignificant effect may be explained by the number of directors serving on financial institutions' board. Financial institutions, particularly, banks, insurance and real estate firms, have larger boards. Agency theory assumes that when the board size exceeds a certain number – usually seven or eight – it is no more effective (Jensen 1993; Lipton and Lorsch 1992). In addition, intense regulations in the financial sector may limit the role of board size. These regulations aim to protect the stability of financial institutions; therefore close and continuous monitoring is expected in the financial sector (Pathan 2009).

The results in both sectors regarding board independence indicate that board independence significantly lowers corporate risk taking. However, the negative effect is stronger in the financial sector. These results with regard to board independence provide support for the reputation hypothesis. The non-executive directors always try to send positive signals to the market to build their own reputation. Further, those directors greatly wish to be viewed as expert monitors and trusted staff. Accordingly, they may take decisions that are less risky to avoid firm losses or lawsuits. Pathan (2009), who reports similar results, notes that the non-executive directors become more conservative due to the regular monitoring from regulators especially in the financial sector. Moreover, these results are consistent with monitoring hypotheses. For the non-executive directors, obtaining information where information asymmetry exists will be costly (Raheja 2005). Accordingly, due to the difficulties and high cost in obtaining information, a negative effect of non-executive directors on corporate risk is expected. This is because those directors cannot properly evaluate the firm's decisions due to the lack of specific and detailed information (Coles et al. 2008; Harris and Raviv 2008; Raheja 2005).

According to the main results, the CEO/Chairperson duality in both non-financial and financial sectors is negatively and significantly related to the corporate risk. The results provide evidence that the CEO who also chairs the board chooses less risky decisions. This is consistent with the agency theory predictions on the possible negative effect of power concentration. Due to the employment risk, managers care a lot about success and firm survival. As the managerial human capital is tied up with the firm they manage, this may create a conflict of interest (Lipton and Lorsch 1992). The selection of safe or in some cases value-reduction projects will not be in the best interests of shareholders (Eisenhardt 1989; Jensen and Meckling 1976). These findings are robust after adjusting risk measures by market, controlling for risk committee, employing an accounting risk measure and applying different sensitivity specification tests.

Chapter 5

Female Participation on the Board of Directors and Corporate Risk Taking

5.1 Introduction

The representation of female on the board of directors has become a critical topic in the academic, social and business areas. Recently, there has been more pressure from shareholders, politicians, press, community and social groups to include more women on corporate boards (Adams and Ferreira 2009; Adams and Funk 2012; Lenard et al. 2014). As a result, female directors have more board seats especially in the US and European countries (Catalyst 2010; Lucas-Pérez et al. 2014). However, the rate of females who reach top positions is still very low. For instance, Catalyst (2010) shows in a recent report that in the US female representation on the boards of Fortune 500 firms was only 15.7%. Furthermore, the report shows that in 2009 and 2010, more than 10% of Fortune 500 firms had no female directors at all. In the UK, a recent report in 2012 by Sealy and Vinnicombe (2012) documents that the percentage of female directors on FTSE 100 boards is 15%, while the rate is 9.4% for FTSE 250 boards.

This has led some countries to introduce specific regulations for female representation on the board of directors. For example, in 2005, Norway was the first country to require all listed firms to have females making up at least 40% of their boards. Similarly, in Spain, in 2007, they encouraged all the listed firms to reach 40% female representation by 2015. Other countries also work on similar guidelines, such as Germany, Belgium and the Netherlands (Adams and Funk 2012; Lenard et al. 2014). One of the reasons that gender diversity has taken on a high public profile is that managers, regulators and corporate governance advocates believe in the positive effect of board diversity on shareholders' value (Carter et al. 2010). In other words, it is not only the issue of improving equal opportunities but also the important economic implications of the female presence on the corporate board (Martín-Ugedo and Minguez-Vera 2014).

Martín-Ugedo and Minguez-Vera (2014) argue that the presence of female directors on the boards is an ethical issue. Therefore, the idea that women are not allowed to join

corporate boards is not acceptable. The authors highlight that female directors affect the governance of the firm, which in turn affects the shareholders' value creation (Martín-Ugedo and Minguez-Vera 2014). In line with these argument, Brammer et al. (2007) indicate that more female directors on the boards means the outcome for society will be more equitable. In addition, the authors encourage changing the view on female presence on the board by saying it should be seen "*not as a means to an end, but as a desirable end in itself*" (Brammer et al. 2007, p. 395).

In the UK, the best practice codes in corporate governance mainly focus on the board of directors in terms of, independence and leadership structure while gender diversity is largely ignored (Brammer et al. 2007). According to the Higgs report, the female executive directors, non-executives and chairs represented only 4%, 6% and 1% respectively on the UK boards for the year 2002. Further, the report explicitly criticises the homogeneity of the majority of UK corporate boards. Higgs (2003, p.42) states that:

"*It is generally assumed that business experience is important for a nonexecutive director. I believe, however, that the qualities necessary for an effective contribution to the board can also be acquired from a variety of backgrounds. The interplay of varied and complementary perspectives amongst different members of the board can significantly benefit board performance. The composition of a board sends important signals about the values of the company. A commitment to equal opportunities which can be of motivational as well as reputational importance is inevitably undermined if the board itself does not follow the same guiding principles*".

The issuance of the Higgs report was followed by several codes and recommendations on best practices in corporate governance in the UK. The focus on gender diversity was highlighted again in the recent UK governance code that was issued in 2010. Therefore, increasing the gender diversity on corporate boards has become a good governance practice in the UK. According to the UK Corporate Governance Code (2010, p.13), "*The search for board candidates should be conducted, and appointments made, on merit, against objective criteria and with due regard for the benefits of diversity on the board, including gender*".

Accordingly, the UK firms responded to these recommendations and increased the proportion of female directors on their boards. Recently, Sealy and Vinnicombe (2012) report that the percentage of the newly appointed female directors in the largest UK firms increased from 11% in 2008, 14.7% in 2009, 13.3% in 2010 to 24.7% in 2012. These figures show the compliance of UK firms with the recent governance recommendations. Moreover, Sealy and Vinnicombe (2012) indicate that, in general, the proportion of female directors who are non-executive directors is higher compared with executives. For example, in 2012, the proportion of executive (non-executive) female directors was 6.6% (22.4%) on FTSE 100 boards. A similar trend was also found in the FTSE 250, where the proportion of executive (non-executive) female directors was 4.6% (11.4%). However, the proportion of female directors who served as board chair was only 1% (2.4%) in FTSE 100 (FTSE 250) respectively. Additionally, only 4% served as female chief executives on FTSE 100 and FTSE 250.

Li and Wearing (2004) examine the presence of non-executive female directors in the largest 350 UK listed companies for the year 2002. The study documents the low representation of non-executive female directors on UK corporate boards, which accounts for only 6% of board membership. The authors argue that those directors who broke the glass ceiling and reached the board of directors suffer from a 'second glass ceiling' that limits their advancement to more powerful positions such as chairperson or CEO of the board. Prior literature indicates that the low representation of female directors on corporate boards is also related to the widespread belief that females are more risk averse (Adams and Ferreira 2009; Adams and Funk 2012; Johnson and Powell 1994).

This chapter aims to provide empirical evidence on the relationship between the presence of female directors and corporate risk taking in the UK public firms. This study is motivated by the ample psychological findings that document the gender differences in the risk-taking behaviour. The rest of the chapter proceeds as follows: section 5.2 provides the hypotheses development. The descriptive statistics on female directors are presented in section 5.3. Section 5.4 provides the empirical analysis results for both the non-financial and the financial sectors. Section 5.5 provides an additional robustness check of the main results. Finally, section 5.6 concludes and summarises the chapter.

5.2 Hypotheses Development

The presence of females in the boardroom is weakly addressed in the literature. However, the existing papers have focused on how female directors affect corporate performance. In general, the empirical evidence in this regard is mixed and inconclusive. For example, Carter et al. (2003), Erhardt et al. (2003), Campbell and Mínguez-Vera (2008), Anderson et al. (2011) and Joecks et al. (2013) report that gender diversity is positively related to corporate value. These studies imply that the presence of female directors on corporate boards does matter for shareholder value creation. The presence of female directors on the board provides an opportunity to gain from diverse and heterogeneous perspectives (Campbell and Mínguez-Vera 2008; Carter et al. 2003; Erhardt et al. 2003).

Further, adding more females on the boards leads to better corporate governance, as the monitoring function is enhanced (Nicholson and Kiel 2007). Adams and Funk (2012) find evidence that female directors are more able to hold the CEO accountable for the firm's poor performance. According to Adams and Funk (2012), the presence of females on the board of directors enhances the monitoring function and increases board independence. However, the findings of Rose (2007), Adams and Ferreira (2009), Ahern and Dittmar (2012) and Chapple and Humphrey (2014) report a negative and insignificant impact between gender diversity and corporate performance. For instance, Adams and Ferreira (2009) provide evidence that including more females on the board enhances the board's independence. Female directors are considered better monitors, and have fewer attendance problems. Further, Adams and Ferreira (2009) argue that the presence of female directors on corporate boards leads to better corporate governance. However, the authors explain that those females exert too much monitoring and this explains the negative association between the presence of female directors and corporate value.

Accordingly, no clear-cut conclusions have been reached on how the female directors are related to the firms' outcomes. Lucas-Pérez et al. (2014) argue that two reasons may lead to these inconclusive results. First, the interdisciplinary of this topic since the arguments on the effect of female directors on corporate value are derived from different theories. The authors indicate that these arguments, which are related to

psychology, economy, sociology and strategic management, make it difficult to draw consistent results on this issue. The second reason is that these studies have considered a direct link between female directors and corporate value without considering other variables that may affect this relationship.

With respect to the impact of female directors on corporate risk taking the empirical evidence is limited and inconclusive. The literature documents the gender differences in risk-taking behaviour (Croson and Gneezy 2009). Most of the psychology and sociology studies show that women perceive risk differently and in general they tend to be more risk averse (Arch 1993; Croson and Gneezy 2009; Eckel and Grossman 2008). These studies provide several reasons that could explain the female risk-aversion behaviour. Some of these explanations refer to evolutionary factors such as the unique female role as a mother and care provider, which leads to more worries and concerns (Gustafsod 1998; Olsen and Cox 2001). Other factors are related to the biological differences, such as higher level of the enzyme monoamine oxidase for females than males, which increases the risk-aversion behaviour (Harlow and Brown 1990; Zuckerman 1994). In addition, the level of testosterone, which is responsible for risk-taking behaviour, is lower for women than men (Sapienza et al. 2009).

The literature documents other factors that explain why females tend to take less risk than males. For example, women tend to be less educated; have lower income and wealth; and are more emotional and less overconfident (Gustafsod 1998; Meehan and Overton 1986; Prince 1993; Slovic 1993). These factors might explain their conservative behaviour and their tendency toward more risk aversion.

The tendency for female directors to take less risk is empirically supported in corporate governance studies. For example, using 1462 US public firms for the year 1998, Adams and Ferreira (2004) find that firms with higher variability in the standard deviation of the monthly stock return include lower female representation on their boards. Elsaid and Ursel (2011) report that the new appointments of female CEOs in 679 US firms lower the risk taking measured by financial leverage, R&D expenses and cash holdings as a percentage from total assets. Consistent with these finding, another piece of evidence comes from 612 international European banks across 20 countries provided by Mateos de Cabo et al. (2012). The authors find that the number of female directors on

the banks' boards is negatively related to the bank risk measured by standard deviation of the return on assets and equity-on-total assets ratio. Recently, Lenard et al. (2014) also document the negative effect of female directors on corporate risk taking measured by the variability of the stock market.

However, another stream in the literature considers that the widespread belief that female are more risk-averse is only a stereotype, while the true economic behaviour in the business place may be different (Johnson and Powell 1994). The literature provides some evidence that females with more education and experience and who are already in high leadership positions may behave differently from females in the general population (Atkinson et al. 2003; Croson and Gneezy 2009; Gysler et al. 2002; Johnson and Powell 1994; Levin et al. 1988; Masters and Meier 1988; Schubert 2006; Schubert et al. 1999) . These papers attribute the similarity between professional males/females in risk-taking behaviour to the selection and experience hypotheses. Since these high leadership positions involve taking risk, this implies that females who select such positions tend to exhibit more risk-taking behaviour. Additionally, the levels of experience and knowledge also matter in such behaviour and encourage females to take more risk.

Empirically, these arguments are also supported. For example, Atkinson et al. (2003) examine the female/male differences in performance and investment behaviour for 1,294 US fixed-income mutual funds in the year 2000. The authors report that both males and females behave similarly with respect to the risk taking in investment behaviour. Adams and Funk (2012) use a questionnaire to examine the core values and risk attitudes for all the directors serving on public and private Swedish boards. The findings document a positive and significant relationship between females on the boards and the measure of risk taking. Accordingly, the authors indicate that this positive evidence breaks the common stereotype that females are more risk-averse. Consistent with these findings, Berger et al. (2014) study how the directors' age, level of education and gender are related to German banks' risk taking. The study creates two groups, a treatment and control group. The treatment group includes the entire bank's board that faces changes in the interested variables. Using the difference-in-difference method, the study finds a positive and significant relationship between female directors on the board and bank risk measures.

Based on the above discussion, and given the large debate in the literature and the inconclusive results, this study proposes the following hypothesis:

Hypothesis 1a*: The proportion of female directors on the board is a determinant of corporate risk taking.*

The literature indicates that the presence of female directors enhances the board's effectiveness and firm value (e.g., Carter et al. 2008; Erhardt et al. 2003; Kang et al. 2007; Lückerath-Rovers 2013; Mahadeo et al. 2012). According to Carter et al. (2008), board diversity adds value to the firm as the board members will have different perspectives, more creativity and unique innovative styles. Further, diversity increases board independence and leads to better understanding of the marketplace, which includes heterogeneous views and opinions (Kang et al. 2007). Gender is considered to be the most influential diversity factor not only in terms of board diversity but also in many other aspects like politics and society (Kang et al. 2007).

More diverse boards increase the ability of board members to solve complex problems, effectively monitor managers and take better decisions (Carter et al. 2008; Hagendorff and Keasey 2011). Based on advantages of gender diversity on corporate boards, it is expected that adding more females to the board will increase board independence, create value and enhance the decision-making process. Similarly, this study proposes that adding more females to the board may have a concave effect on corporate risk taking. In other words, if the proportion of female directors on the board determines corporate risk taking, to what extent does adding more female directors on the board determine corporate risk taking (either positively or negatively)? To look for such ratio and test this effect, the study proposes the following hypothesis:

Hypothesis 1b*: There is a quadratic concave effect of the proportion of female directors on corporate risk taking.*

5.3 Descriptive Statistics

Table 5.1 presents the mean and the standard deviation for the female directors on the UK boards. The table shows statistics for both the financial and the non-financial sectors year by year and for the pooled years as well. As can be noted from Table 5.1,

the percentage of female directors in the financial sector is slightly higher with an overall average of 8% than the non-financial sector with an overall average 7%. In general, the figures in Table 5.1 indicate that the percentage of female directors had gradually increased during the period of the study. The percentage of female directors has increased from 5% in 2003 to 11% in 2012 for the non-financial sector and from 6% in 2003 to 12% in 2012 for the financial sector. For both sectors, it is clear that the UK firms have responded to the recent corporate governance recommendations (2010), which call for more gender diversity on the board of directors. The figures presented in Table 5.1 are in line with recent UK studies (Dowling and Aribi 2013; Gregory-Smith et al. 2014).

Table 5.1 Evolution of Female Directors on the UK Boards

Mean and (Standard Deviation) of the proportion of Female Directors on the Board											
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	All years
NonFinancial	0.05 (0.08)	0.06 (0.09)	0.06 (0.09)	0.07 (0.09)	0.07 (0.09)	0.07 (0.09)	0.07 (0.10)	0.08 (0.09)	0.09 (0.10)	0.11 (0.11)	0.07 (0.09)
Financial	0.06 (0.08)	0.06 (0.08)	0.07 (0.09)	0.07 (0.10)	0.07 (0.10)	0.07 (0.10)	0.08 (0.11)	0.09 (0.12)	0.10 (0.13)	0.12 (0.14)	0.08 (0.11)

Figure 5.1 shows the trend of female directors over the sample period for both sectors. The trend indicates an increase in the percentage of female directors, as seen in Table 5.1. Table 5.2 provides the breakdown of female directors on boards of directors for sample firms by industry. Table 5.2 shows that the higher concentration of female directors is in utilities, telecommunication and consumer goods companies with an average of (11%), (10%), (10%) respectively. However, the lower concentration of female directors appears in the technological companies with an average of (4%). In the financial sector, the higher concentration of female directors appears in banks with an average 14.5%. The averages for female directors in both insurance and financial service firms are almost similar with 8% on average. The lower concentration in the financial sector is in the real estate firms with an average of 5.8%. These figures on both sectors are in line with UK studies (e.g., Li and Wearing 2004).

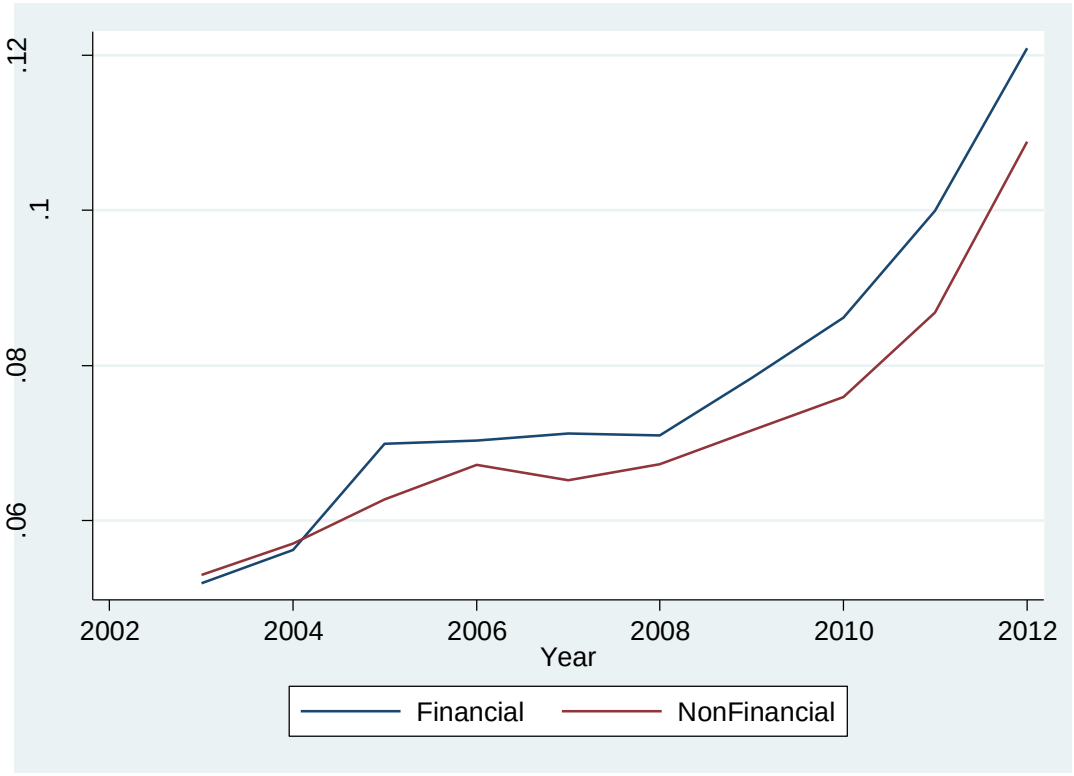

Figure 5.1: The Trend of Female Directors in Financial and Non-Financial Sectors

Table 5.2 Breakdown of Female Directors on Boards for Sample Firms by Industry

Industry	***Mean and (Standard Deviation)***
Financial Sector	
Banks	14.5 % (6.8%)
Insurance	8 % (9%)
Financial services firm	8 % (12%)
Real estate	5.8 % (8.5%)
Non-Financial Sector	
Basic material	5% (9%)
Consumer goods	10% (11%)
Consumer services	9% (10%)
Health care	8% (11%)
Industrials	5% (9%)
Oil and gas	5% (7%)
Technology	4% (7%)
Telecommunication	10% (11%)
Utility	11% (8%)

Table 5.3 shows the number of female directors in both sectors. As noted from Table 5.3, around 116 firms in the financial sector have no female directors at all, which represents 42% from the final sample. Only 160 firms in the financial sector include at least one female on their boards of directors, i.e. 58% of financial firms in our sample. Further, only 3 firms in the financial sector include 4 females on their boards and this is considered the maximum number of female directors in the financial sector. Table 5.3 also shows that only 23% of non-financial firms have no female directors. Moreover, 77% of non-financial firms have at least one female director on their boards of directors, and the maximum number of female is 5 in this sector.

Table 5.3 Number of Female Directors in Financial and Non-Financial Sectors

Financial Sector			**Non-Financial Sector**	
Number of Female	Frequency	Percentage from Final Sample	Frequency	Percentage from Final Sample
0	116	42%	139	24%
1	103	37%	283	48%
2	36	13%	116	20%
3	18	7%	41	7%
4	3	1%	9	1%
5	0	0	1	0.01 %
Number of Firms	**276**	**100%**	**589**	**100%**

5.4 Empirical Results on the Relationship between Female Directors and Corporate Risk Taking

5.4.1 Univariate Analysis

Table 5.3 presents the mean differences of the board structure variables between firms that have female directors on their board and firms that have no female directors at all. Following Adams and Ferreira (2009), this study creates two groups. The first group is firms with no female directors; here the percentage of female directors is zero. The second group is with female directors; here the percentage of female directors is greater than zero. The results in Table 5.3 indicate that for both sectors the presence of female directors is positively related to the board size. This means larger boards include more female directors (Adams and Ferreira 2009; Carter et al. 2003).

Table 5.3 also shows that more independent boards in the non-financial sector include more females. However, the mean differences are not significant in the financial sector. Several empirical papers find a positive relationship between female presence on the board and the percentage of non-executive directors (e.g., Mateos de Cabo et al. 2012). In addition, Table 5.3 indicates that only in the financial sector is a lower percentage of female directors found in firms that have a higher percentage of CEO/Chairperson duality, i.e. that combine the two positions.

Table 5.4 Comparison of Means for Firms with and without Female Representation on UK Boards

Non-Financial Sector			
	With Females	Without Females	*t-statistics*
BSIZE	8.88	7.45	(11.08)***
NED	62.9%	59.8%	(4.39)***
Dual	2.8%	3.5%	(-0.68)
Financial Sector			
	With Females	Without Females	*t-statistics*
BSIZE	8.32	6.69	(12.18)***
NED	78.8%	78.8%	(-0.04)
Dual	0.005	0.015	(-2.06)**

5.4.2 Main Regression Results

In this section, the results for the second empirical model are presented. The regression analysis mainly tests how the female directors on the board of directors affect the firms' outcomes. More specifically, do female directors affect corporate risk taking in UK listed companies? Additionally, is the effect of female directors similar between the financial and non-financial sector? Moreover, if there is a significant effect, is there a concave effect of the presence of female directors on corporate risk taking? To answer these questions, this study employs a dataset from the UK financial and non-financial sectors. In this chapter, the estimation method in the main analysis is system GMM. The choice of this method is to avoid many econometric problems that could arise in the data analysis[9].

In the UK, the recent Corporate Governance Code (2010) recommends the appointment of more female directors to the boards. In addition, the code considers that gender diversity in terms of increasing female representation on corporate boards is a good governance practice. This implies that UK firms increase the number of females on their boards to reflect their compliance with the governance code recommendations. Moreover, following these recommendations may send a positive signal to the shareholders and social groups who view female appointment as a matter of equal opportunities. Furthermore, Gregory-Smith et al. (2014) report insignificant relationship between the presence of female directors and several measures of corporate performance for the largest UK firms listed in FTSE 350. The authors, therefore, argue that in the UK, "*Proposals in favour of greater board diversity may be best structured around the moral value of diversity, rather than with reference to an expectation of improved company performance*" (Gregory-Smith et al. 2014, P.1).

These discussions may lead to consider the presence of female directors on the board as exogenous, since the appointments in most cases happen only to follow certain regulations or to satisfy social groups and media, as they exert some influence in this regard. Consistent with these arguments, Martín-Ugedo and Minguez-Vera (2014) argue that the appointment of female directors on corporate boards comes as a response

[9] See Chapter 3 for more details.

to social and press pressure only. Accordingly, the appointment of female directors on the corporate board could be viewed as a policy issue.

In this chapter and based on the results obtained from Chapter 4, this study considers the board structure variables, i.e. board size, independence and CEO/Chairperson duality control variables, in addition to the firm financial characteristics. The main explanatory variable is the percentage of female directors on the board of directors (GEN). In addition, following Wintoki et al. (2012) and similar to the model specifications in Chapter 4, this study considers all the board structure variables and firm financial characteristics as endogenous except firm age, female percentage on the board and year dummies.

The following models are used to examine the relationship between female directors and corporate risk taking.

$$TR_{it} = \alpha_1 + k_1 TR_{it-1} + k_1 TR_{it-2} + \beta GEN_{it} + \gamma Control_{it} + \theta X_{it} + \mu_i + \varepsilon_{it} \qquad (5.1)$$

$$IDO_{it} = \alpha_1 + k_1 IDO_{it-1} + \beta GEN_{it} + \gamma Control_{it} + \theta X_{it} + \mu_i + \varepsilon_{it} \qquad (5.2)$$

Where TR is total risk,TR_{it-1}, TR_{it-2} is the first and the second lags of total risk, GEN is the percentage of female directors on the board, Control is the control variables including board structure variables (ln (BSize), independence and CEO/Chairperson duality), leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV), and CEO ownership (CEOWN). X_{it} is the exogenous variables including firm age, GEN, and year dummies. In the second model, all the definitions are the same except IDO_{it} is the idiosyncratic risk and IDO_{it-1} is the first lag of idiosyncratic risk.

Table 5.4 presents the regression analysis results of female directors in the non-financial sector. Panel (A) in Table 5.4 reports the results using total risk as a dependent variable while panel (B) reports the results using idiosyncratic risk. Table 5.4 indicates that the coefficient on female directors under total risk is insignificant. This implies that the female directors in the non-financial sector have no impact on the total risk. In contrast, the coefficient on female directors using idiosyncratic risk as a dependent variable is positive and significant where the p-value is (0.007).

The positive and significant relationship under the idiosyncratic risk provides support for hypothesis ***H1a*** in this chapter, which states that the proportion of female directors on the board is a determinant of corporate risk taking. This result implies that female directors in the non-financial sector increase the idiosyncratic risk of the firm. This finding is consistent with the selection and experience hypotheses (Johnson and Powell 1994; Levin et al. 1988; Schubert et al. 1999). According to these hypotheses, the risk attitude of professional females differs from those in the general population (Croson and Gneezy 2009). Females who are in high leadership positions tend to be more risk lovers since these positions require risk taking. In addition, professional females who already have the required training and good experience tend to be more risk lovers (Adams and Funk 2012). Furthermore, Adams and Funk (2012) argue that men and women tend to behave similarly in a predominantly male environment since females may adjust their behaviour in such environments.

This positive and significant result is consistent with Adams and Funk (2012), who find that Swedish female directors tend to increase the risk of the firm. The authors confirm that women in leadership jobs behave in a different way to women in the general population under risk. In addition, our results are consistent with Berger et al. (2014), who examine the German market and find that female directors increase the risk of bank portfolios. Consistent with Adams and Funk (2012), the authors argue that females in top managerial positions may behave differently and they may become even more aggressive than their male counterparts.

The board structure variables provide similar and consistent results to those reported in Chapter 4. Under the idiosyncratic risk, larger boards lower corporate risk taking (Chen 2011; Cheng 2008; Nakano and Nguyen 2012; Pathan 2009). The negative relationship is significant at the 10% level. Further, board independence negatively and significantly impacts the idiosyncratic risk; the p-value is (0.089). This result, as indicated in Chapter 4, provides support for the reputation and monitoring hypotheses (Brick and Chidambaran 2008; Gonzalez and André 2014; Pathan 2009). The coefficient on CEO/ Chairperson duality is negative and significant under both risk measures, indicating that the CEO who also chairs the board takes less corporate risk (Kim and Buchanan 2008; Pathan 2009).

Table 5.4 shows that the control variables hold the expected signs as hypothesised. The coefficient on leverage is positive and significant under total risk and (idiosyncratic risk) where the p-value is 0.000 and (0.011) respectively. This positive effect implies that firms with higher leverage have higher risk. This result is consistent with Adams et al. (2005), Erkens et al. (2012) and Nakano and Nguyen (2012). In addition, Table 5.4 indicates that in the non-financial sector older firms have lower corporate risk. This is clear under both risk measures. The negative and significant relationship suggests that older firms become more experienced and familiar in dealing with corporate risk. This result is consistent with Adams et al. (2005) and Lewellyn and Muller-Kahle (2012).

The results in Table 5.4 document that the coefficient on growth opportunity is negative and significant under both risk measures. This negative relationship, as explained in the previous chapter, indicates that firms with high growth opportunities took higher risk in the past. The reversed causality for growth opportunity is consistent with our empirical test on the relationship between firm characteristics and past corporate risk taking. However, this result suggests that these firms may avoid taking more risk now in order not to expose the firm to more volatility, which is consistent with Hagendorff and Vallascas (2011).

The results in Table 5.4 indicate that the coefficient on the CEO ownership is positive and significant only under the total risk. The positive coefficient on CEO ownership suggests that providing the CEO with more shares increases the total risk of the firm. This positive effect is consistent with the incentive alignment hypothesis. Managers with high stakes will work in the best interests of shareholders as these incentives reduce the agency conflicts (Himmelberg et al. 1999); a similar result was reported by Adams et al. (2005). The coefficient on the firm size in Table 5.4 is negative and significant under both risk measures where the p-value is (0.000). This negative relationship suggests that larger firms are more able to diversify risk and therefore have lower performance variability. Similar results have been reported by previous studies (Akhigbe and Martin 2008; Berger et al. 2014; Cheng 2008).

Table 5.5 The Effect of Female Directors on Corporate Risk in the Non-Financial Sector

This table presents the results of system GMM from estimating models (5.1) and (5.2). The dependent variable is total risk or idiosyncratic risk. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***(A)*** ***Total Risk***	***(B)*** ***Idiosyncratic Risk***
GEN	0.007	0.072***
	(0.269)	(0.007)
ln (BSize)	-0.005	-0.056*
	(0.407)	(0.082)
NED	0.007	-0.108*
	(0.652)	(0.089)
DUL	-0.007*	-0.047*
	(0.098)	(0.055)
LEV	0 .053***	0.129**
	(0.000)	(0.011)
Age	-0.000**	-0.000*
	(0.040)	(0.067)
MTBV	-0.007***	-0.027***
	(0.007)	(0.001)
CEOWN	0.056***	0.045
	(0.008)	(0.609)
FSize	-0.000***	-0.025***
	(0.000)	(0.000)
$Risk_{(t-1)}$	1.059***	0.171**
	(0.000)	(0.037)
$Risk_{(t-2)}$	-0.234***	
	(0.000)	
Constant	0.097***	0.572***
	(0.000)	(0.004)
AR(1) test (p-value)	0.000	0.000
AR(2) test (p-value)	0.499	0.699
Hansen test of over-identification (p-value)	0.509	0.397
Diff-in-Hansen tests of exogeneity (p-value)	0.627	0.339

Moreover, system GMM reports the results of specification tests (AR (1)), (AR (2)), Hansen test of over-identification and differences in Hansen test of exogeneity. Wintoki et al. (2012) indicate that the first-order serial correlation in the first-differenced residuals does exist; however, there should be no second-order serial correlation. Since system GMM uses multiple lags as instruments, Hansen test provides over-identification test under the null hypothesis that the instruments used in the analysis are valid. Further, system GMM assumes that the correlation between the endogenous variables and the unobserved fixed effect is constant overtime (Wintoki et al. 2012,

p.27). This additional exogeneity assumption allows system GMM to use the level equations and use lagged differences as instruments for these levels.

Table 5.4 shows that all these specification tests pass, for example, the p-value for the (AR (2)) test under total risk (idiosyncratic risk) is 0.499 (0.699) respectively. These results suggest that the null hypothesis of no second-order serial correlation is accepted. Similarly, the p-value for Hansen test under total risk (idiosyncratic risk) is 0.509 (0.397), which indicates that our instruments are valid under the two risk measures. The last specification test is the Difference-in-Hansen test. The p-value under total risk (idiosyncratic risk) is 0.627 (0.339) respectively. The results indicate that the null hypothesis that states that the instruments used for the equations in levels are exogenous is accepted.

In Chapter 2, the special features of the financial sector were discussed. In general, financial institutions are more heavily regulated, and more opaque due to the complexity of their operations (Levine 2004). More importantly, financial institutions are operating in a riskier environment and this may lead the directors to behave differently with respect to the risk decisions (Pathan 2009). Therefore, to see if the female directors have the same effect as in the non-financial sector, the study repeats the same analysis using the data from the financial sector. Table 5.5 presents the results for the financial sector. Panel (A) in Table 5.5 where the dependent variable is total risk suggests an insignificant relationship between female directors and total risk in the financial sector. Similarly, in panel (B) the coefficient on female directors is also insignificant under idiosyncratic risk. These results lead us to reject hypothesis ***H1a*** for the financial sector, which states that the proportion of female directors on the board is a determinant of corporate risk taking.

One explanation for this insignificant relationship may be attributed to the number of female directors in the financial sector. The figures in table 5.3 indicate that 42% of the firms in the financial sectors have no female directors at all. Further, 37% of the financial sector firms' have only one female director. Given that the financial institutions are large in size and, compared to the non-financial firms, they have larger boards. For example, the average number of directors in banks, insurance companies, real estate and financial services companies is 14.39, 10.5, 7.74 and 6.3 respectively.

The large board size, especially in banks where the highest number of female directors exists, may explain the insignificant role of female directors. Jensen (1993) argues that when the number of directors is greater than seven or eight this will reduce the effectiveness of the board of directors. In addition, the insignificant effect may be explained in the context of the tokenism phenomenon. This means that the low numbers of female directors on these large boards result in lower influence, and more isolation and self-doubt in male-dominant boards (Kanter 1977).

Another point may be also related to the heavy regulation in this sector, especially after the recent financial crisis. Due to the importance of the financial sector in the stability of all the other sectors, these strict regulations may give less freedom for the directors in the financial institutions to act in their own interests. Additionally, the directors may be pushed by regulation to better look after their institutions. As a result of these tighter regulations, directors in the financial institutions might be more concerned about their reputation, as they would not like to be exposed in cases of failure. In this regard, the literature indicates that the females generally show higher compliance with the rules and regulations (Baldry 1987). Taken together, given the heavy regulations, the higher risk and higher information asymmetry in the financial sector, these factors may limit the female directors playing an active role in the financial institutions.

Table 5.5 indicates that the results on the board structure variables remain the same as reported in Chapter 4. The board independence is negative and significant under both risk measures. However, the CEO/Chairperson duality is negative and significant only under idiosyncratic risk. The controlling variables have the signs as expected and are similar to those reported in Table 5.4. The noticeable difference from Table 5.5 is that the firm size and CEO ownership are not significant under both risk measures in the financial sector.

Furthermore, the specification tests using system GMM indicate that there is no second-order serial correlation in the first-differenced residuals. The p-value for (AR (2)) is 0.295 (0.446) for total risk (idiosyncratic risk) respectively. Further, Hansen test provides p-values of 0.347 and 0.265 for the total risk and idiosyncratic risk respectively. These values confirm that the instruments used are valid. The last test,

which is suggested by Bond et al. (2001), confirms the exogeneity of instruments used in the levels equations.

Table 5.6 The Effect of Female Directors on Corporate Risk in the Financial Sector

This table presents the results of system GMM from estimating models (5.1) and (5.2). The dependent variable is total risk or idiosyncratic risk. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***(A)*** ***Total Risk***	***(B)*** ***Idiosyncratic Risk***
GEN	0.000	0.020
	(0.920)	(0.182)
ln (BSize)	0.003	-0.005
	(0.497)	(0.845)
NED	-0.015**	-0.089***
	(0.021)	(0.001)
DUL	-0.001	-0.029**
	(0.678)	(0.019)
LEV	0 .014*	0 .014
	(0.080)	(0.576)
Age	-0.000***	-0.000**
	(0.002)	(0.011)
MTBV	-0.007**	-0.016**
	(0.010)	(0.039)
CEOWN	0.007	0.085
	(0.369)	(0.477)
FSize	0.000	-0.002
	(0.367)	(0.350)
$Risk_{(t-1)}$	1.199***	0.272***
	(0.000)	(0.000)
$Risk_{(t-2)}$	-0.329***	
	(0.000)	
Constant	0.019*	0.124***
	(0.084)	(0.004)
AR(1) test (p-value)	0.000	0.000
AR(2) test (p-value)	0.295	0.446
Hansen test of over-identification (p-value)	0.347	0.265
Diff-in-Hansen tests of exogeneity (p-value)	0.612	0.542

Taken together, the results from Tables 5.4 and 5.5 suggest that the effect of female representation on corporate boards is different between the non-financial and financial sectors. The results provide evidence that in the non-financial sector the female directors are taking more risk under the idiosyncratic risk. However, no significant effect was found in the financial sector using total or idiosyncratic risk.

To test the second hypothesis, i.e. to test the concave effect of female directors on the board, we include the percentage of female directors squared in the regression analysis, i.e. $(GEN)^2$, to determine the inflection point; see Short and Keasey (1999) for a similar technique. The following model is used to test this relationship:

$$IDO_{it} = \alpha_1 + k_1 IDO_{it-1} + \beta GEN_{it} + \beta(\text{GEN})2_{it} + \gamma Control_{it} + \theta X_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots\ldots (5.3)$$

Where: IDO_{it} is the idiosyncratic risk, IDO_{it-1} is the first lag of idiosyncratic risk. GEN is the percentage of female directors on the board and $(GEN)^2$ is the squared percentage of female directors. Control is the control variables including board structure variables (ln (BSize), independence and CEO/Chairperson duality), leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN). X_{it} is the exogenous variables including firm AGE, GEN, and year dummies.

Table 5.6 reports the results. While the coefficient on female directors is positive and significant in the non-financial sector, indicating that the presence of female directors on the board increases the idiosyncratic risk, the coefficient on the female directors squared is negative and significant. This means that the existence of female directors increases the risk up to a certain point, and then the effect starts to become negatively related to the risk taking. Using both coefficients from Table 5.6 and applying them using "MAPLE" software version (16), the results indicate that the inflection point is 28%.

This means that up to 28% the presence of females on the board creates value and works with shareholders' interests by increasing corporate risk taking. However, if the percentage of female directors on the board exceeds 28% this implies that the effect of

female directors on the board will start to negatively decrease the corporate risk taking. It might be argued that the presence of female directors increases a firm's risk taking; however, after a certain point, those directors may play a moderating role and tend to select less risky investments. Another possible explanation is that, if the female directors' ratio exceeds 28%, the board may suffer from heterogeneity, which may affect the decision-making process and create communication and coordination problems. Accordingly, decision-making on the board will require more time and it will be difficult to reach a consensus (Moscovici and Zavalloni 1969; Sah and Stiglitz 1986; Sah and Stiglitz 1991). This is consistent with the negative coefficient found on the squared term of female proportion reported in Table 5.6. These results lead us to accept ***H1b*** for the non-financial sector, which states that there is a quadratic concave effect of the proportion of female directors on corporate risk taking.

A similar analysis was conducted for the financial sector. While the percentage of female directors is insignificant, Table 5.6 indicates that also the squared term of the female directors is insignificant.

Table 5.7 Testing for the Quadratic Concave Effect of Female Directors and Idiosyncratic Risk

This table presents the results of system GMM from estimating model (5.3). The dependent variable is idiosyncratic risk. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4for variable definitions and measurements.

Dependent Variable	***Non-Financial Sector***	***Financial Sector***
	Idiosyncratic Risk	***Idiosyncratic Risk***
GEN	0.152**	0.032
	(0.012)	(0.340)
GEN^2	-0.313*	-0.031
	(0.095)	(0.623)
ln (BSize)	-0.058*	-0.006
	(0.066)	(0.760)
NED	-0.112*	-0.090***
	(0.087)	(0.001)
DUL	-0.047*	-0.029**
	(0.054)	(0.019)
LEV	0.125**	0.015
	(0.016)	(0.561)
Age	-0.000*	0.001**
	(0.052)	(0.010)
MTBV	-0.027***	-0.016**
	(0.000)	(0.037)
CEOWN	0.046	0.057
	(0.599)	(0.481)
FSize	-0.023***	-0.002
	(0.000)	(0.359)
$Risk_{(t-1)}$	0.174**	0.271***
	(0.028)	(0.000)
Constant	0.555***	0.132***
	(0.000)	(0.004)
AR(1) test (p-value)	0.000	0.000
AR(2) test (p-value)	0.683	0.437
Hansen test of over-identification (p-value)	0.420	0.288
Diff-in-Hansen tests of exogeneity (p-value)	0.457	0.587

5.5 Robustness Checks

In the previous section, the results indicate that there is a difference between the non-financial sector and the financial sector in terms of female directors' impact. According to the main results in this study, in the non-financial sector the female directors take more risk. However, the results show that in the financial sector the effect of female directors is insignificant. In this section, the study provides additional tests to make sure that the results in the previous section are robust.

Alternative Measure of Female Directors on the Board

In the main estimation in the previous section, the female directors on the board were measured as the proportion of female directors. This ratio is obtained by dividing the total number of females on the board by the total number of board size. The study repeats the analysis for both sectors using a different measure for female diversity on the board. Following Carter et al. (2003) and Campbell and Mínguez-Vera (2008), a dummy variable included equal to one if there is at least one female director on the board and zero otherwise. Table 5.7 reports the results for both sectors. Panel (A) indicates that the coefficient on female directors is positive and significant in the non-financial sector under the idiosyncratic risk. In the financial sector, the role of female directors remains insignificant under both risk measures, which confirms our main results in the previous section. Taken together, the results using alternative measures for females directors on corporate board are similar and consistent with the main results obtained in section 5.4.

An Alternative Accounting Risk Measure

The analysis in section 5.4 has used two market risk measures, i.e. total risk and idiosyncratic risk. In this test, the study employs Z-score as an alternative accounting measure for corporate risk taking. This measure indicates the distance from insolvency (Roy 1952). Thus, it shows the number of standard deviations that the firm's return needs to drop below its expected value before equity is depleted; therefore, a higher Z-score value indicates more stability.

Table 5.8 The Effect of Female Directors on Corporate Risk using an Alternative Diversity Measure

This table presents the results of system GMM from estimating models (5.1) and (5.2). The dependent variables are total risk and idiosyncratic risk. ***GEN*** is measured as dummy variable equal to one if there is at least one female director on the board and zero otherwise. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***Panel (A) Non-Financial Sector***		***Panel (B) Financial Sector***	
	Total Risk	***Idiosyncratic Risk***	***Total Risk***	***Idiosyncratic Risk***
GEN	0.001	0.010**	0.000	-0.000
	(0.541)	(0.024)	(0.514)	(0.987)
ln (BSize)	-0.005	-0.057*	0.003	-0.000
	(0.434)	(0.079)	(0.572)	(0.902)
NED	0.014	-0.111*	-0.015**	-0.086***
	(0.343)	(0.094)	(0.022)	(0.002)
DUL	-0.008	-0.049**	-0.003	-0.025**
	(0.151)	(0.049)	(0.559)	(0.017)
LEV	0.055***	0.129***	0.017**	0.014
	(0.000)	(0.000)	(0.048)	(0.545)
Age	-0.001***	-0.001*	-0.001***	-0.001**
	(0.009)	(0.057)	(0.003)	(0.016)
MTBV	-0.008***	-0.027***	-0.007**	-0.016**
	(0.000)	(0.001)	(0.011)	(0.041)
CEOWN	-0.048**	0.051	0.007	0.057
	(0.030)	(0.567)	(0.411)	(0.487)
FSize	-0.005***	-0.024***	0.004	-0.002
	(0.000)	(0.000)	(0.345)	(0.357)
Total Risk$_{(t-1)}$	1.036***	0.171**	1.207***	0.273***
	(0.000)	(0.039)	(0.000)	(0.000)
Total Risk$_{(t-2)}$	-0.209***		-0.334***	
	(0.000)		(0.000)	
Constant	0.096***	0.563***	0.004	0.124***
	(0.000)	(0.000)	(0.667)	(0.007)
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.626	0.697	0.345	0.449
Hansen test of over-identification (p-value)	0.563	0.320	0.148	0.245
Diff-in-Hansen tests of exogeneity (p-value)	0.840	0.400	0.681	0.477

Following Laeven and Levine (2009), Houston et al. (2010) and Vyas (2011), Z-score is calculated as the return on assets plus the capital-asset ratio divided by the standard deviation of asset returns, Z-score=(ROA+CAR)/σ (ROA). Five years of the study sample are used to estimate the population average ROA and σ (ROA). Since a high Z-score means more stability, the study uses (1/Z-score) to indicate insolvency risk and to easily interpret and compare the results.

The results of insolvency risk are reported in Table 5.8 for both sectors. The coefficient on female directors in the non-financial sector is positive and significant; the p-value is significant at 10% level. Consistent with the main results in section 5.4, the coefficient on female directors in the financial sector is insignificant. The results from Table 5.8 confirm the robustness of the main results of this study.

Market-Adjusted Risk Measures

In this test, the study re-estimates models (5.1) and (5.2) after adjusting the risk measures to the market. Given that the variability in the stock returns is affected by different factors in the market as well as by specific factors that are related to the firm, this test is to remove the impact of market factors (Lenard et al. 2014). To obtain the market-adjusted risk measures, for each firm we subtract the monthly return on the FTSE All-Share Index from monthly firm return (Cheng 2008; Lenard et al. 2014).

After adjusting the monthly stock return, the study calculates the standard deviation of market-adjusted return for total risk and the standard deviation of residuals from the Fama and French model for idiosyncratic risk. Table 5.9 presents the results of the market-adjusted risk measures for the non-financial and financial sectors. The results for both sectors remain the same and are consistent with the main results obtained in the previous section. Accordingly, this test confirms that our results are not driven by the market effect.

Table 5.9 The Effect of Female Directors on Corporate Risk Using Z-Score

This table reports the results of dynamic system GMM for estimating models (5.1) and (5.2) using Z-score as a dependent variable. *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***Z-Score***	
	Non-Financial	***Financial***
GEN	0.296* (0.053)	0.020 (0.182)
ln (BSize)	-0.077** (0.050)	-0.003 (0.845)
NED	-0.210* (0.081)	-0.089*** (0.001)
DUL	- 0.104* (0.074)	-0.029** (0.019)
LEV	0.417** (0.029)	0 .014* (0.076)
Age	-0.004* (0.087)	-0.002** (0.011)
MTBV	0.023 (0.384)	-0.016** (0.039)
CEOWN	0.587* (0.100)	0.085 (0.477)
FSize	-0.043 (0.246)	-0.002 (0.350)
$Risk_{(t-1)}$	0.651*** (0.000)	0.272*** (0.000)
$Risk_{(t-2)}$	- 0.247** (0.038)	-0.358** (0.038)
AR(1) test (p-value)	0.000	0.000
AR(2) test (p-value)	0.378	0.446
Hansen test of over-identification (p-value)	0.406	0.265
Diff-in-Hansen tests of exogeneity (p-value)	0.840	0.542

Table 5.10 Market-Adjusted Risk Measures

This table presents the results of system GMM for estimating models (5.1) and (5.2) using market adjusted risk measures. The dependent variable is market adjusted total risk or market-adjusted idiosyncratic risk; all the variables are defined in Table (3.4). *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous.

Dependent Variable	***Non-Financial***		***Financial***	
	Total Risk	***Idiosyncratic risk***	***Total Risk***	***Idiosyncratic risk***
GEN	0.008	0.077***	-0.001	0.026
	(0.248)	(0.008)	(0.708)	(0.121)
ln (BSize)	-0.005	-0.057*	0.006	0.013
	(0.402)	(0.081)	(0.258)	(0.551)
NED	0.002	- 0.106*	-0.014**	-0.097***
	(0.817)	(0.097)	(0.035)	(0.001)
DUL	- 0.010*	- 0.047*	-0.005	-0.055***
	(0.094)	(0.055)	(0.312)	(0.007)
LEV	0.000**	0.000*	0.017**	0.010
	(0.040)	(0.086)	(0.033)	(0.780)
Age	-0.051***	-0.131***	-0.005***	-0.008***
	(0.000)	(0.009)	(0.004)	(0.003)
MTBV	-0.007***	-0.027***	-0.007***	-0.013
	(0.000)	(0.001)	(0.002)	(0.134)
CEOWN	0.055***	0.047	0.004	0.166**
	(0.009)	(0.601)	(0.430)	(0.050)
FSize	-0.005***	-0.025***	0.000	-0.006
	(0.000)	(0.000)	(0.703)	(0.129)
$Risk_{(t-1)}$	1.054***	0.172**	1.172***	0.137***
	(0.000)	(0.034)	(0.000)	(0.000)
$Risk_{(t-2)}$	-0.227***		-0.293***	
	(0.000)		(0.000)	
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.543	0.696	0.254	0.000
Hansen test of over-identification (p-value)	0.462	0.404	0.038	0.361
Diff-in-Hansen tests of exogeneity (p-value)	0.145	0.428	0.474	0.322

Include Additional Control Variables

In the last test, the study controls for more additional variables that may affect corporate risk taking. The first variable is the risk committee (RC) where a dummy variable is used to control for the existence of risk committee. This dummy variable takes one if the firm has a risk committee and zero otherwise. The data on the risk committee was extracted from the BoardEx Database. Including risk committee as a control variable stems from the important role of this committee with respect to the decisions related to the risk taking on the board of directors (Klein 2002). For the second variable, the study controls for the frequency of trading (FRQ). Theoretically, the causes of the trading system in the market refer to the divergence of opinions among traders. In other words, these differences lead to different valuation of the stock, since the volume of trade also reflects this heterogeneity (Demsetz and Strahan 1997). Therefore, a positive relationship is expected between trading volume and price changes (Jones et al. 1994).

Following Anderson and Fraser (2000), Konishi and Yasuda (2004), Pathan (2009) and Nguyen (2011), this study measures the frequency of trading as the average daily volume of shares traded for each firm divided by the total number of shares outstanding for that firm. Table 5.10 reports the results after including these variables. The results in Table 5.10 are similar to and consistent with the results obtained in the previous section. The coefficient on female directors in the non-financial sector remains positive and significant. However, in the financial sector and consistent with the main results the coefficient on female directors is insignificant. Moreover, it is noticeable that the risk committee appears to have a more active role in the financial sector. The coefficients on risk committee are positive and significant under both risk measures in the financial sector while no significant effect is found in the non-financial sector. Regarding the frequency of trading, as expected, in both sectors the frequency of trading is positively and significantly related to both risk measures. This positive effect is consistent with prior empirical papers (Anderson and Fraser 2000; Konishi and Yasuda 2004; Pathan 2009).

Table 5.11 The Effect of Female Directors on Corporate Risk Measures with Additional Controls

This table reports the results of dynamic system GMM for estimating models (5.1) and (5.2) after including Risk Committee (RC) and Frequency of Trading (FRQ). *P-values* are reported in parentheses. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. Hansen test of over-identification is under the null that all instruments are valid. Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous. See Table 3.4 for variable definitions and measurements.

Dependent Variable	***Non-Financial***		***Financial***	
	Total Risk	***Idiosyncratic risk***	***Total Risk***	***Idiosyncratic risk***
GEN	0.008	0.056**	-0.005	0.028
	(0.166)	(0.021)	(0.544)	(0.338)
ln (BSize)	-0.005	-0.055**	0.002	0.007
	(0.369)	(0.026)	(0.575)	(0.626)
NED	-0.005	-0.120*	-0.009**	-0.075***
	(0.722)	(0.100)	(0.038)	(0.000)
DUL	- 0.009*	- 0.043**	0.002	-0.018**
	(0.079)	(0.037)	(0.481)	(0.025)
LEV	0.041***	0.101**	0.014**	0.004
	(0.000)	(0.030)	(0.039)	(0.815)
Age	-0.000**	-0.000*	-0.002**	-0.000
	(0.029)	(0.093)	(0.011)	(0.385)
MTBV	-0.006***	-0.023***	-0.008***	-0.016**
	(0.000)	(0.000)	(0.001)	(0.012)
CEOWN	0.054***	0.045	0.007	0.060
	(0.008)	(0.591)	(0.409)	(0.530)
FSize	-0.006***	-0.026***	-0.000	-0.006
	(0.000)	(0.000)	(0.565)	(0.125)
RC	0.003	0.019	0.004*	0.018*
	(0.418)	(0.201)	(0.099)	(0.071)
FRQ	0.091***	0.368***	0.030**	0.218***
	(0.000)	(0.001)	(0.023)	(0.001)
$Risk_{(t-1)}$	1.042***	0.173**	1.184***	0.283***
	(0.000)	(0.032)	(0.000)	(0.000)
$Risk_{(t-2)}$	-0.225***		-0.317***	
	(0.000)		(0.000)	
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.427	0.825	0.342	0.556
Hansen test of over-identification (p-value)	0.865	0.850	0.445	0.492
Diff-in-Hansen tests of exogeneity (p-value)	0.812	0.899	0.616	0.989

5.6 Summary

This chapter has provided important empirical evidence on the role of female directors on the UK boards of directors. This study investigates how the presence of female directors is related to corporate risk taking. This study covers all the publicly listed firms on the London Stock Exchange in the FTSE All-Share Index. The sample of the current study is constructed from both the financial and the non-financial sectors. However, the analysis is performed separately for each sector. The study covers a 10-year time period from 2003 to 2012.

The academic literature provides support for the importance and the value that the female directors can add to the firm. Having female representation on the board is described as a good governance practice (Carter et al. 2003). More diverse boards, in terms of more female directors, have a better decision-making process (Daily et al. 2003; Hillman et al. 2002). The heterogeneity in such boards, which offers different views and perspectives, leads to more creativity and innovations (Robinson and Dechant 1997). Furthermore, from the resource dependence theory perspective, having more female directors on the board provides access to additional resources in other firms which therefore enhances the firm value (Milliken and Martins 1996). Despite these advantages of female directors, the widespread belief that women are more risk averse limits the number of females in high leadership positions. This stereotype has led to a statistical discrimination against women in terms of positions offered and the type of duties assigned to them(Johnson and Powell 1994).

This study provides evidence that female directors increase corporate risk by using a sample that includes female directors sitting on UK corporate boards. Several authors argue that females in high leadership positions behave differently from those in the general population and in some cases similarly to their male counterparts (Atkinson et al. 2003; Johnson and Powell 1994). One of these reasons is related to the selection hypothesis (Croson and Gneezy 2009). Based on this hypothesis, females that choose these positions tend to exhibit more risk-taking behaviour. The reason behind this is that such high managerial positions already require taking risk. Thus, those few females who choose such jobs usually have the same risk behaviour as their male counterparts (Johnson and Powell 1994). Another reason that explains the positive link between

female directors and corporate risk may be related to the experience hypothesis. Women who are better informed and trained and have more experience tend to be more risk lovers (Levin et al. 1988; Schubert et al. 1999).

Consistent with these arguments, this study finds a positive and significant relationship between female directors on the board and corporate risk taking in the non-financial sector. In addition, the study finds a concave effect of the presence of female directors on corporate risk. The findings document that, up to 28%, the female directors in the non-financial sector work in line with shareholders' interests by taking more risk. However, the findings show that if the ratio of female directors exceeds 28% the presence of female directors starts negatively reducing corporate risk.

The results for the financial sector reveal that the role of female directors is insignificant. This insignificant effect may be attributed to the heavy regulation in the financial sector, which may limit the female directors from having active roles, since more regulation will give less chance for the directors to behave in their own interests. In addition, the larger board size in the financial institutions probably intensifies the tokenism phenomenon as those few women on the board could feel self-doubt, isolation and lower confidence (Kanter 1977). According to this study, the higher concentration of female directors is in banks and the figure shows that banks have the largest board size in all the industries and in both financial and non-financial firms, with an average of 14.39 directors.

The recent recommendations of the UK Corporate Governance Code with respect to enhancing board diversity have received some support from the findings of this study. Boards with more female directors increased the risk taking of the firms. Consequently, the increased number of female directors on the board can be viewed positively and in line with shareholders' interests. This positive effect suggests that the advancement of female directors on corporate boards has significant economic value.

Chapter 6

Board Structure, Female Participation on the board and Corporate Risk Taking during the Recent Financial Crisis

6.1 Introduction

The recent financial crisis 2007-2009 has been viewed in the eyes of most economists as being worse than the Great Depression (Adams 2012; Erkens et al. 2012; Gupta et al. 2013). Although the crisis started in the financial sector, it negatively affected the main stock markets worldwide (Balli et al. 2013; Bernanke 2009; Gupta et al. 2013). The negative consequences of the recent crisis led to most of the financial and credit markets freezing up, sharp decreases in the stock prices and most investors losing their confidence particularly in the financial sector (Adams 2012; Kirkpatrick 2009).

In the aftermath of the recent financial crisis, governments of developed countries had to intervene to defend their economies. For example, in 2008, the US government interfered to insure more than $700 billion of the financial institutions' assets. A similar step was taken by the UK government, which announced "a rescue package" reaching £500 billion in the same year (Erkens et al. 2012). The consequences of the recent financial crisis also led the British government to bail out many large financial institutions. Northern Rock, Bradford and Bingley, Alliance and Leicester, HBOS and Cheshire and Derbyshire all suffered from substantial defaults during the recent financial crisis in the UK (Akbar et al. 2013). For example, Northern Rock was supported by an emergency loan from the Bank of England at the onset of the crisis; however, by February 2008 Northern Rock had gone into state ownership (Hall 2008).

Academics, journalists, and policymakers have questioned the adequacy of corporate governance systems in the recent financial crisis (Spong and Sullivan 2012). Corporate governance assumed to limit managerial opportunism, enhance firm value and serve as guidance for management towards optimal behaviour; weak corporate governance has been considered as a main causes of the crisis (Adams 2012; Bebchuk et al. 2010; Beltratti and Stulz 2012; Kirkpatrick 2009). Certainly, several factors contributed to the

recent financial crisis; however, some elements are considered more relevant than others.

For example, in 2008, the Senior Supervisors Group (SSG), which consists of the senior supervisors' of the largest financial services firms in Canada, France, Germany, Japan, Switzerland, the United Kingdom, and the United States, determined that failures in four governance areas contributed to the recent crisis. The first one is related to the ineffectiveness of the board of directors in determining, managing and evaluating firm risk. The second one is related to the arrangements that serve the risk takers in the firms. In addition, the report issued by the Senior Supervisors Group highlighted that the compensation system did not match firm objectives. Finally, the report has criticised the poor infrastructure which led to poor risk identifications and measurements in the financial institutions (Senior Superviors Group 2009).

In 2009, another report was issued by the OECD, the Steering Group on Corporate Governance. This report also attributed the recent financial crisis to the weakness in corporate governance. Kirkpatrick (2009, p.1) argues that "*the financial crisis can be to an important extent attributed to failures and weaknesses in corporate governance arrangements which did not serve their purpose to safeguard against excessive risk taking in a number of financial services companies*". One of the critical governance arrangements is the board of directors. In the aftermath of the crisis there was a large consensus from different parties that the board of director had failed to perform as expected (Adams 2012; Balli et al. 2013; Spong and Sullivan 2012).

The board of directors is the main internal governance mechanism that is expected to mitigate agency problems and enhance firm value (Pearce and Zahra 1992). In particular, the boards are responsible for setting and monitoring the implementation of firm policy (John and Senbet 1998). More importantly, all the strategic decisions, which determine the success or failure of the firm, are also entrusted to the board of directors (Spong and Sullivan 2012). Since these decisions involve risk, an effective board should be able to carry out the risk management role that protects the firm from losses and serves the shareholders' interests (Aebi et al. 2011; Ingley and van der Walt 2008; Sabato 2010; Tao and Hutchinson 2013). However, the recent financial crisis revealed several weaknesses related to the effectiveness of the board (Balli et al. 2013).

In the financial sector, one of the main factors that contributed to the failure of financial institutions during the recent crisis was excessive risk taking (Erkens et al. 2012). Spong and Sullivan (2012) discuss that large monetary incentives that were provided to managers in the financial institutions encouraged them to take on more risk. A detailed discussion for this excessive risk-taking behaviour in the financial sector was provided in Chapter 2. Due to these reasons in the above discussion, the focus on the board of directors was heightened (McNulty et al. 2013). The aim of this chapter, therefore, is to provide empirical evidence from the recent financial crisis. In particular, this chapter examines the effect of board structure and the presence of female directors on corporate risk taking in three different sub-periods. These periods are pre-crisis, crisis and post-crisis.

The rest of this chapter proceeds as follows: section 6.2 provides the hypotheses development in this chapter. The descriptive statistics on the risk-taking measures in the pre-crisis, during and post-crisis periods as well as for the full period of the study are presented in section 6.3. Section 6.4 presents the results from the univariate analysis and the main regression model. Section 6.5 provides additional sensitivity tests using alternative definitions for the crisis period. Finally, section 6.6 summarises the chapter.

6.2 Hypotheses Development

The discussion in Chapter 2 on the role of the board of directors during the recent crisis has revealed the limited number of empirical papers that examine the relationship between board structure and corporate risk taking in the crisis period. Further, the findings on the relevance of board structure seem to be inconsistent. For instance, Erkens et al. (2012) report that the proportion of independent directors on US financial institutions boards has no impact on corporate risk before or during the crisis periods. However, Minton et al. (2014) find that only the independent directors with financial experience who serve on the boards of the largest US banks took higher risks in the pre-crisis period; while the authors report that the independent directors lowered bank risk during the crisis period. Both studies based their findings on the OLS.

In the UK, McNulty et al. (2013) include only 141 large non-financial firms; the OLS results report that that larger boards lowered financial risk. Further, the study reports an

insignificant relationship between independent directors, CEO/Chairperson duality and financial risk in the crisis period. Another piece of conflicting evidence from the UK which uses OLS is by Gonzalez and André (2014), who find that there is a positive relationship between board size and corporate risk taking. Moreover, the authors report a negative and significant relationship between board independence and corporate risk. It is worth noting that Gonzalez and André (2014) report the results for the full period 1992-2010 and do not consider a special analysis for the crisis period.

The effect of female directors on the board of directors was discussed in the previous chapter. The recent financial crisis led Harriet Harman, deputy leader of the UK Labour Party, to criticise the male domination of the senior positions of financial institutions. Harman indicated that, if these financial institutions had higher female representation on their boards, the meltdown caused by the crisis might have been less. Her famous argument states that "*Somebody did say ... that if it had been Lehman Sisters, rather than Lehman Brothers, then there may not have been as much*" (Morris 2009). Consistent with these arguments, the EU commissioner, Michel Barnier, argued that the higher representation of female directors on financial institutions' boards could enhance corporate governance practices and also end what is called "group-think", which intensifies the crisis (Treanor 2011).

Prior literature did not provide a clear link on how the presence of female directors affects corporate outcomes and particularly corporate risk taking (Adams and Ferreira 2004; Adams and Funk 2012; Barua et al. 2010; Berger et al. 2014; Elsaid and Ursel 2011; Lenard et al. 2014; Mateos de Cabo et al. 2012). In addition, none of these studies examines the effect of female directors on corporate risk in the crisis period.

Taken together, it is clear that more investigation is required in addressing how the effect of board size, independence, CEO/Chairperson duality and the presence of females on corporate boards are related to corporate risk during the recent crisis. The limited empirical work and the mixed results also reveal the need for more empirical evidence. This chapter relies on the same theoretical literature used in Chapters 4 and 5 to develop the hypotheses on board structure variables and female directors on corporate risk taking. However, to consider the effect of the recent financial crisis these hypotheses are tested in three different sub-periods. The pre-crisis period is defined as

(2004-2006). Following Akbar et al. (2013), Kontonikas et al. (2013), and Florackis et al. (2014), the crisis period is defined as 2007-2009. The post-crisis period is defined as (2010-2012). To avoid repetition, the study directly proposes the following hypotheses:

Hypothesis 1a*: There is a negative relationship between board size and corporate risk taking in the pre-crisis period.*

Hypothesis 1b*: There is a negative relationship between board size and corporate risk taking in the crisis period.*

Hypothesis 1c*: There is a negative relationship between board size and corporate risk taking in the post-crisis period.*

Hypothesis 2a*: There is a negative relationship between board independence and corporate risk taking in the pre-crisis period.*

Hypothesis 2b*: There is a negative relationship between board independence and corporate risk taking in the crisis period.*

Hypothesis 2c*: There is a negative relationship between board independence and corporate risk taking in the post-crisis period.*

Hypothesis 3a*: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the pre-crisis period.*

Hypothesis 3b*: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the crisis period.*

Hypothesis 3c*: There is a negative relationship between CEO/Chairperson duality and corporate risk taking in the post-crisis period.*

Hypothesis 4a*: The proportion of female directors on the board is a determinant of corporate risk taking in the pre-crisis period.*

Hypothesis 4b*: The proportion of female directors on the board is a determinant of corporate risk taking in the crisis period.*

Hypothesis 4c*: The proportion of female directors on the board is a determinant of corporate risk taking in the post-crisis period.*

6.3 Descriptive Statistics

Table 6.1 presents the average risk measures in the financial sector. This table shows the average risk measures for banks, financial service firms, insurance companies, and real estate firms in the three different sub-periods. "Full period" includes the full sample period from 2003 to 2012. "Pre-crisis" period includes the years from 2004 to 2006. Following, Akbar et al. (2013), Kontonikas et al. (2013), and Florackis et al. (2014) the "crisis period" is defined as 2007-2009. "Post-crisis" period includes the years from 2010 to 2012. The study starts the pre-crisis period from 2004 instead of 2003 to offer a balanced period around the crisis event as, by doing this, both the pre and post periods will cover three years. In addition, balanced periods around the crisis event mitigate the issue of skewness in the degrees of freedom in the pre and post periods; see Lemmon and Roberts (2010) for a similar approach.

From Table 6.1, the increase in both risk measures, i.e. total risk and idiosyncratic risk, between the pre and crisis periods is noticeable. For example, the overall average for total risk (idiosyncratic risk) in banks is 9.3% (3.8%) for the full period. The average total risk (idiosyncratic risk) increased from 7.5% (2.3%) in the pre-crisis period to 10% (5.6%) in the crisis period.

Table 6.1 also provides similar trends for the risk measures before and during the crisis period for the financial services and the real estate firms. However, only the figures related to the insurance companies show a decrease in both risk measures in the crisis period. The average total risk (idiosyncratic risk) before the crisis is 9.9% (5.6%) while in the crisis period the average total risk (idiosyncratic risk) decreased to 8% (3.5%). Table 6.1 also indicates that banks and real estate companies have the highest risk in the crisis period. Figure 6.1 provides a consistent trend on both risk measures in the financial sector. It is noted from Figure 6.1 that there is a sharp increase in total risk and

idiosyncratic risk for the years 2007-2009, which is considered the crisis period in this study. A noticeable feature related to the post-crisis period in the financial sector is the continuous increase in the average total risk. By contrast, the average idiosyncratic risk decreased in the post-crisis period for the four industries in the financial sector. These figures may support that the idiosyncratic risk is more influenced and controlled by the directors' decisions.

Table 6.2 presents the average risk measures in nine industries within the non-financial sector. Most of the figures in Table 6.2 show that the average risk measures for most of the industries have increased in the crisis period. Firms in the technology industry have the highest risk measures in the crisis period. For example, the average total risk for the firms in the technology industry has increased from 12.4% in the pre-crisis period to 13.4% in the crisis period. It is noticeable that the average risk measures in technology firms are considered the highest in both financial and non-financial sectors.

Likewise, the average idiosyncratic risk has increased from 11% in the pre-crisis period to 11.7% in the crisis period. However, the lowest risk measures are found in the utilities firms where the average total risk (idiosyncratic risk) decreased from 5.7% (1.5%) in the pre-crisis period to 5.4% (1%) in the crisis period. Figure 6.2 presents the trends of total and idiosyncratic risk over the period 2003-2012. Clearly, both risk measures have noticeably increased in the years 2007-2009, i.e. the crisis period.

Table 6.1 Industry Breakdown of Risk Measures in the Financial Sector Pre, During and Post the Recent Crisis

This table presents the average risk measures according to the industry classification. "Full period" includes the years 2003 to 2012. "Pre-crisis" includes the years 2004-2006, "crisis period" includes the years 2007-2009 and "post-crisis" includes the years 2010-2012.

Industry	*Period*	*Total Risk*	*Idiosyncratic Risk*
Banks	**Full period**	**0.093**	**0.038**
	Pre-crisis	0.075	0.023
	Crisis	0.100	0.056
	Post-crisis	0.120	0.025
Financial Service Firms	**Full period**	**0.077**	**0.019**
	Pre-crisis	0.075	0.021
	Crisis	0.076	0.023
	Post-crisis	0.083	0.012
Insurance Firms	**Full period**	**0.086**	**0.037**
	Pre-crisis	0.099	0.056
	Crisis	0.080	0.035
	Post-crisis	0.076	0.018
Real Estate Firms	**Full period**	**0.063**	**0.019**
	Pre-crisis	0.063	0.019
	Crisis	0.106	0.055
	Post-crisis	0.126	0.021

Figure 6.1: Trends of Risk Measures in the Financial Sector

Table 6.2 Industry Breakdown of Risk Measures in the Non-Financial Sector Pre, During and Post the Recent Crisis

This table presents the average risk measures according to the industry classification. "Full period" includes the years 2003 to 2012. "Pre-crisis" includes the years 2004-2006, "crisis period" includes the years 2007-2009 and "post-crisis" includes the years 2010-2012.

Industry	*Period*	*Total Risk*	*Idiosyncratic Risk*
Basic Materials	**Full period**	**0.120**	**0.064**
	Pre-crisis	0.092	0.050
	Crisis	0.132	0.092
	Post-crisis	0.154	0.055
Consumer Good	**Full period**	**0.092**	**0.041**
	Pre-crisis	0.093	0.037
	Crisis	0.091	0.054
	Post-crisis	0.094	0.031
Consumer Services	**Full period**	**0.104**	**0.051**
	Pre-crisis	0.102	0.044
	Crisis	0.103	0.066
	Post-crisis	0.109	0.045
Health Care	**Full period**	**0.117**	**0.062**
	Pre-crisis	0.111	0.059
	Crisis	0.122	0.079
	Post-crisis	0.123	0.050
Industrial	**Full period**	**0.105**	**0.046**
	Pre-crisis	0.097	0.037
	Crisis	0.110	0.062
	Post-Crisis	0.119	0.041
Oil & Gas	**Full period**	**0.098**	**0.057**
	Pre-Crisis	0.082	0.049
	Crisis	0.104	0.072
	Post-crisis	0.114	0.053
Technology	**Full period**	**0.146**	**0.094**
	Pre-crisis	0.124	0.110
	Crisis	0.134	0.117
	Post-crisis	0.121	0.056
Telecommunication	**Full period**	**0.108**	**0.060**
	Pre-crisis	0.138	0.072
	Crisis	0.100	0.063
	Post-crisis	0.075	0.041
Utilities	**Full period**	**0.050**	**0.012**
	Pre-crisis	0.057	0.015
	Crisis	0.054	0.010
	Post-crisis	0.037	0.010

Figure 6.2: Trends of Risk Measures in the Non-Financial Sector

6.4 Empirical Results

This section provides the empirical results on the relationship between board structure, female directors and corporate risk taking pre, during and post the recent financial crisis 2007-2009. The first part in the empirical results presents the univariate analysis, i.e. the mean (median) differences level of the board structure variables and the presence of females on the board of directors pre, during and post crisis. The second part presents the main regression analysis on the board structure variables, female participation on the board and corporate risk within these three sub-periods.

6.4.1 Univariate Analyses

This section shows the mean (median) differences level of the board structure variables and percentage of female directors on the board. Table 6.3, panel (A) reports mean (median) differences from the pre-crisis period (2004-2006) and the crisis period (2007-2009) for the financial sector. Panel (A) shows that both board size and percentage of non-executive directors are significantly different between the pre-crisis and crisis periods. The board size decreased from 8.02 to 7.84 directors while the percentage of non-executive directors increased from 73.2% to 75.4% in the financial institutions. However, no significant change is observed for the CEO/Chairperson duality between the pre-crisis and crisis periods. Furthermore, the presence of female directors significantly increased from 6.5% in the pre-crisis to 7.7% in the crisis period.

Panel (B) in Table 6.3 shows mean (median) differences between the pre-crisis period (2004-2006) and the post-crisis period (2010-2012) for the financial sector. In other words, it shows how the firms in the financial sector adjust their board structure variables in the aftermath of the recent crisis. The results in panel (B) show that the board size significantly decreased in the post-crisis period. This decrease is more significant that the one observed in panel (A). Similarly, the percentage of non-executive directors significantly increases in the post-crisis period. With respect to the CEO/Chairperson duality, no significant change is observed in the post-crisis period in the financial sector. There is a noticeable increase in the presence of female directors on the financial institutions' boards from 6.7% in the pre-crisis to 10.3% in the post-crisis period. Taken together, the mean and median differences for board size, independence

and presence of female directors is more significant than those values in panel (A). This implies that the financial institutions significantly changed these variables in the aftermath of the crisis, which also reveals more compliance with the 2010 UK code recommendations.

For the non-financial sector, panel (C) in Table 6.3 shows that board size significantly decreased from 8.23 to 8.06 directors in the crisis period. In addition, the percentage of non-executive directors increased from 57.1% in the pre-crisis period to 61% in the crisis period. Unlike the financial sector, the CEO/Chairperson duality decreased from 4% in the pre-crisis period to 3.4% in the crisis period. The presence of female directors significantly increased from 5.7% to 6.8% in the crisis period.

The changes in the board structure variables in the post-crisis period are highly significant. For example, from panel (D) the non-financial firms adjust their board size after the crisis by decreasing the number of directors from 8.29 (in the pre-crisis) to 8.04 (in the post-crisis). The board independence increased from 57% in the pre-crisis to 63% in the post-crisis period. Moreover, the CEO/Chairperson duality significantly decreased from 4% in the pre-crisis to 2.6 in the post-crisis period for the non-financial firms. The firms in the non-financial sector significantly increased the presence of females on their boards from 5.5% in the pre-crisis to 9.1% in the post-crisis period.

The results in Table 6.3 indicate the following observations. First, both the financial and non-financial firms show more compliance to the UK Corporate Governance Code recommendations by decreasing the board size and increasing the board independence, and increasing female representation, in addition to separating the roles of CEO and chairperson for the non-financial firms. Second, from panel (B) and (D) the values of t-statistics and the Wilcoxon rank (z) provide evidence that the board structure and female presence on the board are significantly changed more in the post-crisis period. Third, the changes in the board structure following the crisis period, i.e. post-crisis period, especially the increase in the non-executive directors in both sectors, is consistent with Hermalin and Weisbach (1988) and Perry and Shivdasani (2005), who argue that firms usually increase board independence by adding more non-executive directors following a sudden change in the business environment.

Table 6.3 Mean and Median Differences of Board Structure Variables pre, within and post the Recent Crisis

This table presents the mean and median differences of board size (BSIZE), non-executive directors (NED), and CEO/Chairperson duality (DUL), the proportion of female directors (GEN) in the pre-, during and post-crisis periods. Pre-crisis includes the years 2004-2006, the crisis period includes the years 2007-2009 and post-crisis includes the years 2010-2012. Panels (A) and (B) report the results for the financial sector while panels (C) and (D) report the results for the non-financial sector.

Panel (A) Mean (Median) Differences Pre- and During Crisis Period ***Financial Sector***				
	Pre-Crisis	***Crisis***	***t-statistics***	***Wilcoxon rank (z)***
BSIZE	8.029	7.840	(2.6784)***	(2.327)**
NED	0.732	0.754	(-6.278)***	(-6.552)***
Dual	0.017	0. 012	(1.1342)	(1.134)
GEN	0.065	0.077	(-3.6882)***	(-2.912***)
Panel (B) Mean (Median) Differences Pre- and Post-Crisis Period ***Financial Sector***				
	Pre-Crisis	***Post-Crisis***	***t-statistics***	***Wilcoxon rank (z)***
BSIZE	7.71	7.39	(3.7182)***	(3.524)***
NED	0.773	0.808	(-7.9258)***	(-8.039)***
Dual	0.012	0.007	(1.1002)	(1.004)
GEN	0.067	0.103	(-6.7316)***	(-6.709)***
Panel (C) Mean (Median) Differences Pre- and During Crisis Period ***Non-Financial Sector***				
	Pre-Crisis	***Crisis***	***t-statistics***	***Wilcoxon rank (z)***
BSIZE	8.233	8.065	(3.6682)***	(2.854)***
NED	0.571	0 .610	(-14.17)***	(-14.555)***
Dual	0.040	0.034	(1.6231)*	(1.622)*
GEN	0.057	0.068	(-4.8793)***	(-4.604)***
Panel (D) Mean (Median) Differences Pre- and Post-Crisis Period ***Non-Financial Sector***				
	Pre-Crisis	***Post-Crisis***	***t-statistics***	***Wilcoxon rank (z)***
BSIZE	8.29	8.04	(3.9436)***	(3.039)***
NED	0.57	0.63	(-14.9418)***	(-14.524)***
Dual	0.040	0.026	(3.1446)**	(3.130)***
GEN	0.055	0.091	(-11.1629)***	(-11.130)***

6.4.2 Main Regression Results

This section presents the main results on the relationship between board structure, female directors on the board and corporate risk taking pre, within and post the recent financial crisis. As indicated above, the period of the study is divided into three sub-periods, pre-crisis (2004-2006), crisis period (2007-2009) and post-crisis period (2010-2012). The definition of the crisis period is similar to Akbar et al. (2013), Kontonikas et al. (2013), and Florackis et al. (2014). To examine how the board structure and the presence of female directors are related to the corporate risk in these periods, this study employs the following model:

$$Corporate\ Risk\ taking_{it} = \alpha + \alpha_1\ ln\ (BSize)_{it} + \alpha_2\ NED_{it} + \alpha_3\ DUL_{it} + \alpha_4\ GEN_{it} + \alpha_5\ Control\ variables + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6.1)$$

Where ***Corporate Risk taking*** is either total risk or idiosyncratic risk; ***ln (BSize)*** is the natural logarithm of total number of directors on the board; ***NED*** is the percentage of non-executive directors on the boards; ***DUL*** is the CEO/Chairperson duality; ***GEN*** is the percentage of female directors on the board; ***Control variables*** include leverage (LEV), firm size (FSIZE), firm age (AGE), growth opportunity (MTBV) and CEO ownership (CEOWN) and dummies for each year and for each industry. See Table 3.6 for the variable definitions and measurements

Following Baltagi and Wu (1999) and Pathan (2009), this study runs the generalised least square (GLS) random effects (RE) technique in the main analysis. Pathan (2009, p. 1343) argues that this method *"is robust to first-order autoregressive (AR(1)) disturbances (if any) within unbalanced-panels and cross-sectional correlation and/or heteroskedasticity across panels*". The problem in model (6.1) is that the study period is divided into three sub-samples and each one includes three years only. For instance, pre-crisis period includes the years 2004, 2005, and 2006. This is similar to the number of years for the crisis and post-crisis periods. This classification is consistent with the literature in terms of the crisis definition. However, it creates a problem in the analysis. The point is, the analysis cannot be done using system GMM as it requires at least five consecutive years' data, and this is not the case for the sub-samples created in this

chapter. Therefore, and to control for the effect of endogeneity, the empirical strategy includes several steps to minimise the effect of such an issue in the estimation.

First, following Boone et al. (2007) and Pathan (2009), this study controls for simultaneity by introducing instrumental variables for all the endogenous variables. The instrumental variables are the "lagged values" of the endogenous variables. Accordingly, all the explanatory variables except firm age in model (6.1) enter with one lag. Second, to control for unobservable heterogeneity, this study follows Coles et al. (2008) and Linck et al. (2008) and includes year and industry fixed effects by introducing dummies for each year and each industry within the financial and non-financial sectors. Finally, this study follows Linck et al. (2008) and estimates robust standard errors to control for serial correlation and heteroscedasticity using the option "Robust" in STATA 13. However, it is important to note that the results should be interpreted with caution since GLS is unable to control for dynamic endogeneity that may arise in the model.

Table 6.4 presents the main results using generalised least square (GLS) random effect (RE). Panel (A) reports the results for the financial sector using total risk and idiosyncratic risk as dependent variables, while Panel (B) reports the results for the non-financial sector. The findings for both the financial and the non-financial sectors suggest that the board size is insignificant in the three periods. This means that in the pre-crisis, crisis and post-crisis periods the board size has no impact on corporate risk taking under both risk measures. Accordingly, ***H1a, H1b*** and ***H1c*** are rejected for both sectors. These results are consistent with our results in Chapter 4 for the financial sector only. However, the results change for the non-financial sector. In Chapter 4 a negative and significant relationship was found between board size and idiosyncratic risk. The reason may be related to the dynamic endogeneity in the model and to the change in the estimation method. In particular, this insignificant relationship in this chapter is consistent with the results obtained using OLS in Chapter 4.

Table 6.4 shows that the relationship between the non-executive directors and corporate risk is negative and significant in the financial sector. This negative relationship is found in the pre-crisis, crisis and post-crisis periods. These results are consistent with our findings in Chapter 4 for the financial sector specifically: an increase in non-

executive directors lowers risk-taking in the three sub-periods. These findings are consistent with the reputation hypothesis (Fama 1980). According to this hypothesis, the non-executive directors may select less risky investment to avoid exposing the firm to losses or failure risk in order to protect their own reputation in the market (Fama 1980). The non-executive directors show more compliance with the government rules and regulations and therefore they may avoid supporting risky decisions that could lead to default in some cases (Pathan 2009). The negative effect is also consistent with Cheng (2008), who argues that the heterogeneous perspectives and views of the non-executive directors result in lower performance variability.

Moreover, the negative impact of non-executive directors on risk taking is also consistent with the monitoring hypothesis (Boone et al. 2007; Coles et al. 2008; Demsetz and Lehn 1985; Prendergast 2000; Raheja 2005). According to this hypothesis, the monitoring function is less effective in uncertain environments. As the information asymmetry increases, the monitoring cost also increases (Raheja 2005). Thus, the non-executive directors may not be able to evaluate investment decisions because of the high cost of obtaining such information Bargeron et al. (2010). Further, Raheja (2005) and Prendergast (2000) argue that the board monitoring is negatively related to the corporate risk taking in such environments. The results obtained in the financial sector are consistent with Minton et al. (2014), who find that the non-executive directors in the US banks significantly lower bank risk in the crisis period. Other US supporting empirical evidence on the negative effect of non-executive directors is also found in Kim and Buchanan (2008), Brick and Chidambaran (2008), Pathan (2009) and Gonzalez and André (2014).

Table 6.4 GLS Random Effect (RE) Regression Results

This table presents the main results on the relationship between board structure and corporate risk taking in the pre, within and post recent financial crisis. Pre-crisis includes the years 2004-2006, the crisis period includes the years 2007-2009 and post-crisis includes the years 2010-2012. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. See Table 3.4 for variable definitions and measurements.

	Financial Sector (A)						***Non-Financial Sector (B)***					
	Pre-Crisis		***Crisis***		***Post-Crisis***		***Pre-Crisis***		***Crisis***		***Post-Crisis***	
	TR	***IDO***	***TR***	***IDO***	***TR***	***IDO***	***TR***	***IDO***	***TR***	***IDO***	***TR***	***IDO***
ln (BSize)	0.004	0.008	0.011	0.001	0.000	0.009	0.001	-0.008	-0.000	0.001	-0.011	0.007
	(0.446)	(0.394)	(0.166)	(0.963)	(0.886)	(0.306)	(0.795)	(0.225)	(0.922)	(0.948)	(0.188)	(0.629)
NED	-0.043***	-0.057***	-0.038**	-0.069**	-0.012*	-0.045**	0.021*	0.079***	0.001	-0.060	0.010	0.020
	(0.002)	(0.007)	(0.019)	(0.028)	(0.100)	(0.014)	(0.053)	(0.001)	(0.925)	(0.295)	(0.574)	(0.557)
DUL	0.009	-0.020	0.022	-0.033*	0.010	-0.008	-0.000	-0.014	-0.008	-0.045**	0.013	-0.017
	(0.147)	(0.135)	(0.282)	(0.096)	(0.342)	(0.319)	(0.895)	(0.243)	(0.239)	(0.035)	(0.257)	(0.331)
GEN	0.014	0.015	-0.003	0.021	-0.012	0.008	0.023	0.032*	-0.004	0.004	0.020	0.056
	(0.580)	(0.741)	(0.859)	(0.620)	(0.185)	(0.547)	(0.359)	(0.060)	(0.885)	(0.957)	(0.301)	(0.131)
LEV	0.015*	0.017	0.071***	0.095***	0.004	0.036*	0.091**	0.004	0.063***	0.150***	0.079***	0.068**
	(0.052)	(0.356)	(0.007)	(0.008)	(0.950)	(0.065)	(0.028)	(0.834)	(0.000)	(0.002)	(0.000)	(0.015)
Age	-0.002***	-0.001**	-0.002***	-0.004***	-0.002***	-0.001***	-0.001***	-0.004***	-0.001**	-0.004**	-0.001	-0.001
	(0.000)	(0.036)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)	(0.000)	(0.026)	(0.023)	(0.278)	(0.291)
MTBV	0.002	0.000	0.001	-0.007	0.003*	-0.004	-0.001	0.003	-0.014***	-0.019**	-0.013***	-0.014***
	(0.551)	(0.974)	(0.833)	(0.557)	(0.068)	(0.455)	(0.550)	(0.125)	(0.000)	(0.018)	(0.000)	(0.003)
CEOWN	0.044	0.065	0.043***	0.130***	-0.023**	0.044	-0.014	0.063	0.063	0.104	0.003	0.027
	(0.577)	(0.537)	(0.001)	(0.000)	(0.026)	(0.225)	(0.700)	(0.433)	(0.171)	(0.277)	(0.958)	(0.611)
FSize	-0.002	-0.007***	-0.001	0.000	(0.001)	-0.002**	-0.007***	-0.008***	-0.012***	-0.020***	-0.015***	-0.014***
	(0.184)	(0.003)	(0.918)	(0.861)	(0.420)	(0.044)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.128***	0.180***	0.106***	0.134**	0.146***	0.085***	0.198***	0.121***	0.330	0.409***	0.392***	0.223***
	(0.001)	(0.000)	(0.001)	(0.024)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Industry dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Model fits:												
Within R^2	0.24	0.11	0.22	0.17	0.12	0.10	0.29	0.14	0.25	0.10	0.11	0.15
Between R^2	0.30	0.40	0.43	0.31	0.27	0.18	0.40	0.32	0.31	0.18	0.31	0.17
Overall R^2	0.30	0.30	0.40	0.26	0.26	0.17	0.41	0.21	0.30	0.13	0.29	0.13

In the non-financial sector, the results are different with respect to board independence. Table 6.4 reports a positive and significant relationship between non-executive directors and both risk measures, i.e. total risk and idiosyncratic risk, only in the pre-crisis period. However, the effect of non-executive directors is insignificant in the crisis and post-crisis periods. The positive evidence suggests that, in the non-financial sector, the non-executive directors work in line with shareholder interests and support taking more risky investments. In addition, this positive effect in the pre-crisis period provides support to the monitoring hypothesis where the non-executive directors moderate the managerial risk-averse behaviour and enhance the firm value maximisation (Dalton et al. 1998; Eisenhardt 1989; Jensen and Meckling 1976).

The positive effect of non-executive directors in the pre-crisis period is also consistent with Minton et al. (2014), who find that the percentage of non-executive directors who are financial experts is positively related to the corporate risk in the pre-crisis period. However, the authors note that this relationship is no more significant in the crisis period when the bank risk is measured by real estate loans. During the crisis, the proportion of non-executive directors is insignificantly related to both risk measures. This is consistent with prior papers that examine the effect of board structure during the recent crisis and report that the non-executive directors are insignificantly related to the corporate risk during the crisis period (Erkens et al. 2012; McNulty et al. 2013). Similarly, in the post-crisis period no impact is found for the non-executive directors on corporate risk taking. Taken together, the evidence from the financial sector documents the negative effect of the proportion of non-executive directors on corporate risk in the pre-crisis, crisis and post-crisis periods. This leads us to accept ***H2a, H2b*** and ***H2c*** for the financial sector; however, ***H2a, H2b*** and ***H2c*** are rejected for the non-financial sector.

In both sectors, the effect of CEO/Chairperson duality is similar where it is insignificant in the pre- and post-crisis periods. However, in both sectors the CEO/Chairperson duality is negative and significant only in the crisis period and only under the idiosyncratic risk. The p-value on the CEO/Chairperson duality in the financial (non-financial) sector is 0.096(0.035) respectively. These results imply that in both sectors firms with CEO/Chairperson duality took less risk during the crisis. These

results may be explained as follows: in the crisis period where most firms suffer losses, those CEOs who also chair the board take less risk to avoid exposing their firms to more losses. Given that, the effect of CEO/Chairperson duality is insignificant in both pre and post periods; in other words, this negative effect could be attributed to the crisis. Moreover, these results provide support to Adams (2012), who finds that governance quality in the financial and non-financial firms is comparable in the recent financial crisis.

The results on CEO/Chairperson duality are also consistent with the agency theory where managers are risk averse due to their prospects for future employment (Amihud and Lev 1981; Jensen and Meckling 1976). McNulty et al. (2013) report that CEO/Chairperson duality is not significant in determining corporate risk during the recent crisis. To my knowledge, there are no other papers that have examined this particular relationship during the crisis. Taken together, the findings from Table 6.4 in both sectors provide support to ***H3b***, which states a negative relationship between CEO/Chairperson duality and corporate risk taking in the crisis period. However, ***H2a*** and ***H2c*** are rejected for both sectors.

Consistent with our results in Chapter 5, the proportion of female directors is insignificant in the financial sector. In the three sub-periods, no impact is found for female directors on corporate risk taking. The results in the non-financial sector document a positive and significant relationship between the proportion of female directors and idiosyncratic risk only in the pre-crisis period. However, the coefficients on female directors are insignificant in the crisis and post-crisis periods. The positive effect implies that female directors adopt risky investment choices before the crisis happens, while when the crisis hits no significant role is found, and this continues to the post-crisis period. To my knowledge, no empirical papers can be found with which to compare our results, i.e. examine the impact of female directors in the pre-, crisis and post-crisis periods. This positive impact in the non-financial sector is consistent with Adams and Funk (2012) and Berger et al. (2014).

6.5 Robustness Check

In the previous section, the definition of the crisis period includes three years, that is, 2007, 2008 and 2009. In this section, the study re-estimates model (6.1) using two alternative definitions for the crisis period. Aebi et al. (2011), Fahlenbrach and Stulz (2011) and Beltratti and Stulz (2012) define the crisis period from July 1, 2007 to December 31, 2008. However, since the governance variables in this study were collected on an annual basis, we consider the first definition of the crisis period as 2007-2008[10]. The second alternative definition for the crisis period is 2007-2010. This definition is similar to Gupta et al. (2013). Table 6.5 reports the results for both financial and non-financial sectors using theses definitions. To mitigate the endogeneity concerns, this study follows the same strategy explained in section 6.3.2.

In the financial sector, Table 6.5 reports similar and consistent findings to those obtained in the main analysis under the two alternative definitions for the crisis. Consistent with the main results in section 6.3.2, the board size has no impact on corporate risk taking under the two additional crisis definitions. The non-executive directors during the crisis periods lower corporate risk taking under both risk measures. However, only the CEO/Chairperson duality is no more significant under the 2007-2008 definition. The change in the coefficient from negative to insignificant on CEO/Chairperson duality was only under the OLS estimation, which is expected due to the limitation of this technique in controlling for the endogeneity problem (Wintoki et al. 2012). Consistent with the main results in section 6.3.2, the coefficient on female directors is insignificant under the additional crisis definitions in the financial sector.

In the non-financial sector, the findings in panel (B) provide similar and consistent results to the main findings in the previous section only when the crisis period definition is 2007-2010. According to this definition, the CEO/Chairperson duality is negatively related to the corporate risk taking during the crisis. Similarly, using 2007-2010 as a crisis period, the GLS estimation indicates that the coefficients on board size and non-executive directors are insignificant, which is consistent with findings in Table 6.4. However, using 2007-2008 as a definition for the crisis period in the non-financial

[10] This definition of 2007-2008 includes only one year, therefore the analysis for this period is performed using the OLS technique since the number of observations limit using GLS. However, the same strategy in section 5.4.2 is also applied to the OLS to mitigate the endogeneity problem.

sector, the OLS estimation indicates a negative and significant effect between non-executive directors and corporate risk taking. Moreover, the coefficient on CEO/Chairperson duality is no more significant. The change in the results under the OLS estimation is not surprising because in Chapter 4 the analysis shows that the OLS estimation is biased and yields inconsistent parameters. The reason may be attributed to the dynamic endogeneity which the OLS technique is unable to control for. Wintoki et al. (2012) argue that the flip in the signs on the coefficients from static and dynamic estimation methods can be attributed to the limitation in static models in considering the dynamic endogeneity effect in the analysis.

Table 6.5 Alternative Definitions for the Crisis Periods

This table presents the results on the relationship between board structure and corporate risk using alternative definitions for the crisis periods. Panel (A) reports the results for the financial sector while panel (B) reports the results for the non-financial sector. All t-statistics are based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level, respectively. See Table 3.4 for variable definitions and measurements.

	Financial Sector (A)				***Non-Financial Sector (B)***			
	2007-2008		***2007-2010***		***2007-2008***		***2007-2010***	
	OLS		***GLS***		***OLS***		***GLS***	
	TR	***IDO***	***TR***	***IDO***	***TR***	***IDO***	***TR***	***IDO***
ln (BSize)	-0.004	-0.030	0.011	0.005	0.003	0.016	-0.002	-0.012
	(0.489)	(0.125)	(0.187)	(0.638)	(0.604)	(0.405)	(0.713)	(0.427)
NED	-0.038***	-0.079***	-0.053***	-0.040**	-0.010	-0.103*	0.002	-0.041
	(0.003)	(0.007)	(0.000)	(0.044)	(0.563)	(0.078)	(0.860)	(0.374)
DUL	0.023	-0.045	0.018	-0.023*	0.001	-0.034	-0.008*	-0.027*
	(0.371)	(0.165)	(0.384)	(0.085)	(0.857)	(0.197)	(0.100)	(0.095)
GEN	-0.003	0.045	-0.007	0.014	0.005	0.011	0.007	0.002
	(0.860)	(0.247)	(0.586)	(0.615)	(0.811)	(0.810)	(0.703)	(0.989)
LEV	0.077***	0.086***	0.049**	0.076***	0.030**	0.050	0.061***	0.096***
	(0.000)	(0.004)	(0.033)	(0.008)	(0.043)	(0.228)	(0.000)	(0.006)
Age	-0.009***	-0.001***	-0.000***	-0.005***	-0.001*	-0.000*	-0.001**	-0.004**
	(0.000)	(0.002)	(0.000)	(0.002)	(0.065)	(0.084)	(0.032)	(0.018)
MTBV	0.005	0.016	-0.007**	0.009	-0.013***	-0.019*	-0.012***	-0.001
	(0.276)	(0.152)	(0.033)	(0.248)	(0.001)	(0.058)	(0.000)	(0.706)
CEOWN	0.136***	0.170***	0.026*	0.146***	0.004	0.091	0.048	0.087
	(0.000)	(0.000)	(0.077)	(0.000)	(0.901)	(0.464)	(0.147)	(0.318)
FSize	-0.001	-0.001	0.000	0.001	-0.011***	-0.018***	-0.013***	-0.015***
	(0.453)	(0.667)	(0.933)	(0.545)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.133***	0.190***	0.128***	0.092*	0.282***	0.353***	0.334***	0.299***
	(0.001)	(0.001)	(0.001)	(0.057)	(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	Included	Included	Included	Included	Included	Included	Included	Included
Industry dummies	Included	Included	Included	Included	Included	Included	Included	Included
Model fits:								
Within R^2			0.27	0.13			0.30	0.06
Between R^2			0.41	0.33			0.32	0.15
Overall R^2	0.50	0.32	0.39	0.27	0.33	0.23	0.31	0.13

6.6 Summary

This chapter has examined how the board structure in terms of board size, independence, CEO/Chairperson duality and the presence of female directors is related to the corporate risk taking during the recent financial crisis. In this chapter, the study period is divided into three sub-periods. The pre-crisis period includes 2004-2006, the crisis period 2007-2009 and the post-crisis period 2010-2012. The definition of crisis period is consistent with recent research papers (Akbar et al. 2013; Florackis et al. 2014; Kontonikas et al. 2013). However, due to the sub-samples that are created for this purpose, it is not possible to employ the dynamic panel estimator system GMM, which requires at least five consecutive years of data. Therefore, this study follows Pathan (2009) and employs the generalised least square (GLS) random effect (RE) technique in the main analysis.

In the financial sector, the findings in this chapter indicate that the board size is insignificant in the pre-crisis, crisis and post-crisis periods. These findings are similar to those obtained in Chapter 4 using the full period. The insignificant role of the board size in the financial institutions may be attributed to the heavy regulation in the financial sector (Andres and Vallelado 2008; Macey and O'Hara 2003; Pathan 2009). Another possible explanation is the number of directors serving on these boards. In general, the financial institutions have larger boards. According to agency theory, when the board size becomes too large, it is no longer effective (Jensen 1993; Lipton and Lorsch 1992).

Further, the board independence in the financial institutions lowers corporate risk taking in the three sub-periods, i.e. pre, during and post crisis. This negative effect is found under both risk measures. The results on board independence are consistent with our findings in Chapter 4 using the full period. This implies that the conservative role of non-executive directors in the financial sector is the same either pre, during or post the crisis. As the financial sector is more heavily regulated, this may explain the non-executives' conservative behaviour and the higher compliance with regulations with respect to risk taking (Pathan 2009). The strong negative relationship in the financial sector between the proportion of non-executive directors and corporate risk taking

could also be attributed to the greater information asymmetry in the financial institutions compared to the non-financial firms, which in turns makes it difficult for those directors to properly evaluate investment decisions (Andres and Vallelado 2008; Levine 2004; Pathan 2009; Raheja 2005).

The CEO/Chairperson duality is negative and significant in the crisis period only for the financial sector. However, it is insignificant in the pre and post crisis. This negative effect found in the crisis period is consistent with our results in Chapter 4 using the full period. This negative effect could be explained as those managers (who hold both CEO and Chairperson positions) change their risk behaviour because of the crisis, taking less risk in this difficult period just to avoid exposing the firm to more losses and also to protect their positions. These results provide support for the agency theory where managers are more risk averse as a result of employment concerns (Amihud and Lev 1981; Eisenhardt 1989; Jensen and Meckling 1976; Smith and Stulz 1985).

The presence of female directors in the financial sector is insignificant in the pre-crisis, crisis and post-crisis periods. These results are consistent with our findings in Chapter 5 using the full period. The insignificant role of female directors in the financial institutions may be attributed to the heavy and strict government regulations or could be explained by the large size of boards of directors in this sector, which may limit those few females from exerting influence on board decisions.

In the non-financial sector, with respect to the board size, it is noticeable that, when the analysis is conducted using sub-samples, no significant effect is found in the non-financial sector, i.e. pre, within, or post crisis. However, in Chapter 4 the findings document a negative and significant relationship between board size and idiosyncratic risk only. The change in the results could be attributed to the change in estimation method particularly; the insignificant effect is consistent with our results in Chapter 4 under the OLS estimation. In the non-financial sector, the proportion of non-executive directors is positive and significant in the pre-crisis period while pre and post crisis it is insignificant. This implies that the non-executive directors work in line with shareholders' value maximisation by advocating more risky investments in the pre-crisis period where the economic conditions were stable. However, their effect is no more significant in the crisis or post-crisis periods. These results are inconsistent with

our findings in Chapter 4 using the full period, where the effect of non-executive directors is negative and significant under the idiosyncratic risk.

One possible explanation may be the existence of dynamic endogeneity in the model, given that the board independence is highly debated in the literature as it is unobservable (Hermalin and Weisbach 1988, 1991, 1998). Additionally, the positive effect found in the pre-crisis period is similar and consistent with the positive effect that was reported by the OLS technique using the full period in Chapter 4. Therefore, as indicated above, the results should be interpreted with caution since our estimation method in this chapter, i.e. GLS, is unable to control for dynamic endogeneity.

The effect of CEO/Chairperson duality in the non-financial sector is similar to the one obtained in the financial sector. The results report a negative and significant relationship between CEO/Chairperson duality and idiosyncratic risk only in the crisis period. In addition, this negative effect is also consistent with our findings in Chapter 4 using the full period in the main analysis. Consistent with our results in Chapter 5, the proportion of female directors is positive and significant in the pre-crisis periods only. However, in the crisis or in the post-crisis periods no significant effect is found between female directors on the board and corporate risk in the non-financial sector.

Chapter 7

Summary and Conclusion

7.1 Introduction

This study has investigated the effect of board structure and the presence of female directors on corporate risk taking in UK financial and non-financial firms. In this chapter, the results from the empirical chapters are summarised and discussed. In addition to the summary of the research findings, this chapter highlights and addresses other major points such as the restatement of the research questions, the contribution and implications of the study findings, the limitations of the study and some suggestions for future research.

7.2 Restatement of the Research Questions

In the aftermath of the recent financial crisis, corporate governance has received more and more attention (Adams 2012; Aebi et al. 2011; Beltratti and Stulz 2012; Erkens et al. 2012; McNulty et al. 2013). The collapse of large corporations, especially during the crisis 2007-2009, revealed the weakness in the corporate governance system. The board of directors, which is considered to be the main internal corporate governance mechanism, was the focus of attention (Adams 2012; Gupta et al. 2013; Kirkpatrick 2009). The board of directors is responsible for all the strategic decisions in the firm, where the success of the firm depends on how the board effectively performs its duties and protect shareholders' rights (Jensen 1993) . Further, the board's gender diversity in terms of female representation provides several advantages that enhance the effectiveness of the board of directors. The literature indicates that more diverse boards gain more advantages from the heterogeneity and different perspectives (Carter et al. 2003; Kang et al. 2007).

In this study, the target was to answer three important empirical questions. The first question was: Does the board structure determine the corporate risk-taking behaviour in

UK firms? The second empirical question was: Does inclusion of female directors on the board determine the corporate risk-taking behaviour in the UK firms? The last question was: Does the board structure and the presence of female directors on the board determine the corporate risk-taking behaviour of UK firms during the recent financial crisis?

7.3 Summary of the Research Findings and Implications

The results of this study provide evidence that the structure of the board of directors and the presence of female directors do matter with respect to corporate risk taking in the UK. The empirical findings show that the effects of board structure and female representation are different between the financial and non-financial firms. In the first empirical chapter, the study relies on the agency theory assumptions as the main theoretical background; whereas, in the second empirical chapter, investigating the effect of female directors relies on different theoretical perspectives due to the interdisciplinary of the subject, such as human capital theory, agency theory, social psychology theory and resource dependence theory.

This study constructs two samples including all the publicly listed firms in the FTSE All-Share Index on the London Stock Exchange. The first sample includes all the non-financial listed firms in the FTSE All-Share Index. The final number of non-financial firms reached 589 listed companies. The second sample includes only the financial sector, i.e. banks, insurance companies, real estate and financial services firms. The final sample of the financial sector included 276 listed companies. The study covers a 10-year time period, from 2003 to 2012. The choice of this period is to utilise the most recent data and provide up-to-date evidence as well as to include the effect of the recent financial crisis.

This study investigates the empirical models using a dynamic panel estimator, i.e. two step generalised method of moments (system GMM). The main challenge in any corporate governance study is how to control for the endogeneity problem. The literature documents that the board structure variables are endogenously determined (Hermalin and Weisbach 1991, 1998). Therefore, using the traditional estimation methods will not provide consistent results because they fail to control for all the

sources of endogeneity. The dynamic panel estimator system GMM controls for three types of endogeneity, namely unobservable heterogeneity, simultaneity and dynamic endogeneity. This technique uses the lags (historical values) of corporate risk, board structure variables and firm financial characteristics as instruments for current changes in these variables.

7.3.1 The Effect of Board Structure on Corporate Risk Taking

This section displays the main results from Chapter 4. This chapter investigates the effect of board structure variables in the non-financial and financial sector on corporate risk taking. The findings indicate that larger boards have lower corporate risk taking measured by the idiosyncratic risk but not under the total risk. This negative and significant effect is found in the non-financial sector only. However, the board size in the regulated industries has no effect on the corporate risk taking. The findings in the financial sector document an insignificant relationship between board size under both risk measures, i.e. total and idiosyncratic risk. The findings in the non-financial sector provide support for ***H1***, which states that there is a negative relationship between board size and corporate risk taking. Accordingly, ***H1*** is accepted for the non-financial sector and rejected for the financial sector.

The negative effect that is found in the non-financial sector provides support for the agency theory. It has been suggested that larger boards are less efficient in the decision-making process due to the communication/coordination problems (Jensen 1993). It takes more time to agree on a decision in larger boards, which results in a slow decision-making process (Cheng 2008; Nakano and Nguyen 2012; Raheja 2005; Wang 2012). Moreover, the finding are also consistent with economics and social psychology studies that suggest in larger groups extreme decisions are usually rejected and the final decision is considered as a compromise reflecting the views of all the group members (Moscovici and Zavalloni 1969; Sah and Stiglitz 1991). Further, the negative effect between board size and corporate risk taking is consistent with the prior studies from the US market (Cheng 2008; Kim and Buchanan 2008; Pathan 2009; Wang 2012), from Japan (Nakano and Nguyen 2012), from China (Chen 2011), from New Zealand (Koerniadi et al. 2014) and with the evidence from the UK (McNulty et al. 2013).

The insignificant effect of board size in the financial sector may be attributable to the heavy and strict regulation in the financial sector. These regulations may require that these institutions clearly link the risk-taking behaviour with their policies and objectives. Accordingly, this could limit the freedom of the directors on the board and, whatever the board size is, strict regulations should be followed. Further, the insignificant effect could be explained by the number of directors serving on the board. Compared with the non-financial firms, most of the financial institutions have larger boards. For example, the average board size in banks is 14.39 directors. Agency theory argues that when board size become too large it becomes ineffective due to the coordination and communication problems (Eisenberg et al. 1998; Jensen 1993; Lipton and Lorsch 1992; Yermack 1996). The large number of directors on the boards slows down the decision-making process.

Regarding board independence, in both sectors the findings in Chapter 4 have documented similar effects. The non-executive directors on the board are significantly and negatively related to the corporate risk taking. These findings provide support for ***H2***, which states that there is a negative relationship between board independence and corporate risk taking. Accordingly, hypothesis ***H2*** is accepted for both financial and non-financial sectors. In the financial sector, the coefficients on board independence under both risk measures are negative and significant where the p-value is (0.081) and (0.001) for total risk and idiosyncratic risk respectively; while, in the non-financial sector, the coefficient on board independence is negative and significant under the idiosyncratic risk only and with a p-value (0.071). According to these results, it is noticeable that the effect is stronger in the financial sector particularly under the idiosyncratic risk.

These findings are consistent with arguments from the monitoring hypothesis that suggests in uncertain environments the level of information asymmetry is higher and, accordingly, the monitoring function of the board is less effective (Coles et al. 2008; Harris and Raviv 2008; Raheja 2005). Due to the lack of specific details and information and the high cost of acquiring such information, the non-executive directors, who are less informed than insiders, select less risky investments as they are unable to evaluate such investments properly (Boone et al. 2007; Brick and Chidambaran 2008; Linck et al. 2008). Moreover, Cheng (2008) argues that the non-

executive directors with their different and heterogeneous backgrounds are expected to moderate the board decisions and lower the corporate risk taking The results also provide evidence that the negative effect is stronger in the financial sector particularly under the idiosyncratic risk where the p-value is (0.001). This is can be explained as follows: in the financial sector there is greater information asymmetry and more opaqueness (Andres and Vallelado 2008; Levine 2004; Macey and O'Hara 2003), which means the non-executives' task becomes more difficult.

The findings with respect to the board independence also provide support to the agency theory, in particular to the reputation hypothesis. According to Fama and Jensen (1983b), the non-executive directors serve as experts in monitoring and controlling the system and they care about their reputation in the labour market. Therefore, the non-executive directors may choose less risky decisions in order to avoid exposing the firm to losses or lawsuits which may send a negative signal to the external market (Pathan 2009). Moreover, this negative effect of non-executive directors on corporate risk taking is in line with the argument of Cheng (2008). According to Cheng (2008), the non-executive directors have different views and backgrounds; this heterogeneity moderates the risky decisions on the board and thus lowers corporate risk taking. The negative relationship found in this study is consistent with prior research papers that were conducted in the US (Cheng 2008; Kim and Buchanan 2008; Pathan 2009).

The last board structure variable is the CEO/Chairperson duality. In both sectors, the findings provide evidence that combining the roles of CEO and chairperson of the board lower corporate risk taking. The findings document a negative and significant effect of CEO/Chairperson duality using either total risk or idiosyncratic risk in the non-financial sector. However, the negative effect appears in the financial sector when corporate risk taking is measured by idiosyncratic risk only. Accordingly, ***H3***, which states that there is a negative relationship between CEO/Chairperson duality and corporate risk taking, is accepted for the financial and non-financial firms.

The negative association between CEO power and corporate risk taking is consistent with agency theory assumptions. Due to the employment risk and inability of managers to diversify their human capital, managers tend to be more risk averse (Baysinger and Hoskisson 1990). Accordingly, increasing the power in the CEO's hands serves the

managerial opportunistic behaviour and results in less risky investment choices. This negative relationship is in line with prior US studies (Kim and Buchanan 2008; Pathan 2009).

7.3.2 The Effect of Female Participation on the Board and Corporate Risk Taking

Chapter 5 empirically examines the effect of board diversity in terms of female representation on corporate risk taking. The analysis in this chapter considers the percentage of female directors as the main explanatory variable while the board structure variables in addition to the firm financial characteristics are treated as control variables. Similar to Chapter 4, the analysis was conducted separately for the non-financial and financial sectors to capture any similarities or differences. Mainly the chapter tests if the female directors on the board determine corporate risk taking in the UK. In addition, given the importance of diversity, the study tests if the proportion of female directors has a quadratic concave effect on corporate risk-taking.

The main findings in Chapter 5 suggest that the presence of female directors in the non-financial firms is positive and significant. This implies that the female directors increase corporate risk taking in the non-financial sector. The coefficient on female directors is positive and significant in the non-financial sector where the p-value is (0.007) under the idiosyncratic risk only. However, the findings show that the effect of female directors in the financial sector is insignificant under both risk measures. Accordingly, ***H1a***, which states that the proportion of female directors on the board is a determinant of corporate risk-taking, is accepted for the non-financial sector and rejected for the financial one.

The findings in Chapter 5 suggest that the presence of female directors on the board of directors has a quadratic concave effect on corporate risk taking in the non-financial sector. After including the squared term of the proportion of female directors in the specification model, the findings indicate that the female directors in the non-financial sector increase corporate risk taking to a certain point and then the effect starts to be negative beyond that point. Using MAPLE software, the findings show that this point is 28%. This means that when the ratio of female directors on the board is 28% or less the effect of female directors on corporate risk is positive. However, when the ratio of

female directors exceeds 28%, the presence of female directors leads to lower corporate risk taking. A similar approach is conducted in the financial sector, and it is found that neither the proportion of female directors nor the squared term is significant. Accordingly, ***H1b*** is accepted for the non-financial sector and rejected for the financial one.

The positive association between female directors and corporate risk taking in the non-financial sector provides support to the selection and experience hypotheses. According to these hypotheses, females in high leadership positions are considered professional so they have the required qualifications for these positions. In addition, most of the decisions in these positions require taking risk; thus it is expected that females who select these positions will behave similarly to their male counterparts (Croson and Gneezy 2009). Further, females with more experience, high qualification and good training are expected to take more risky decisions (Johnson and Powell 1994; Schubert et al. 1999). The positive relationship that is found in the non-financial sector is consistent with evidence from Sweden (Adams and Funk 2012) and from Germany (Berger et al. 2014) where similar results were reported.

The different impact of female directors in both sectors may be attributed to the heavy rules and regulations in the financial sector. These strict regulations may limit the roles of female directors on the board. Further, the board size of the financial institutions is larger; thus it is expected that the few females on these large boards have less effective roles compared to the non-financial sector where the size of the board is relatively smaller. Jensen (1993) argues that when the number of directors is greater than seven or eight this will reduce the effectiveness of the board of directors. In addition, the insignificant effect may be explained in the context of the tokenism phenomenon. This means that the few numbers of female directors on these large boards result in lower influence, and more isolation and self-doubt (Kanter 1977).

7.3.3 The Effect of Board Structure, Female Participation on the Board and Corporate Risk Taking during the Recent Financial Crisis

In Chapter 6, the study examined the effect of board structure and female participation on the board of directors during the recent financial crisis. Following Akbar et al. (2013), Kontonikas et al. (2013) and Florackis et al. (2014), the study defines the

crisis period as 2007-2009. According to this definition, the crisis period includes three years. Although this definition is consistent with prior literature, it limits us employing system GMM in the main analysis since this technique requires at least five consecutive years to work. Therefore, this study follows Pathan (2009) and employs GLS as the main estimation method in this chapter. The findings after considering the crisis effect indicate that, during the crisis period, board size has no impact on corporate risk taking in both sectors.

In the non-financial sector, the non-executive directors are positively related to the corporate risk in the pre-crisis period. However, no significant effect is found for the non-executive directors in the crisis period. The positive effect in the pre-crisis period supports the monitoring hypothesis, which suggests that the non-executive directors work in line with shareholders' interests in enhancing the corporate value (Fama and Jensen 1983b). In the financial sector, the non-executive directors negatively lower corporate risk taking in the pre, post and during the crisis periods.

This conservative behaviour may be explained in the context of monitoring and reputation hypotheses, as explained above. Further, in both sectors, the CEO/Chairperson duality is negatively related to the corporate risk taking during the crisis period only; however, no significant effect is found in the pre- or post-crisis periods for this variable. The presence of female directors on the boards of UK non-financial firms is positively and significantly related to the corporate risk taking only in the pre-crisis period, while no significant effect is found for the female directors on corporate risk in the financial sector in the three sub-periods.

7.3.4 Implications of the Study Findings

The findings of this study have several important theoretical and practical implications. This study contributes to the existing literature within the context of corporate governance and corporate risk taking. Thus, the findings of this study provide theoretical and empirical advancement in understanding how the structure of the board may determine the firm's outcome. The significant relationships between board structure variable and corporate risk taking support and augment agency theory. For instance, agency theory assumes that, as the board size increases, the agency conflicts

also increase (Jensen 1993). These large boards are less effective in monitoring and in the decision-making process due to the communication/coordination problems (Lipton and Lorsch 1992).

Furthermore, the findings on the board structure and corporate risk taking are practically important for regulators and policymakers. The regulators in the UK who work on the corporate governance code emphasise the importance of board of directors as the main internal control system in the firm in all the issued series of governance codes. Moreover, the role of the board of directors was heightened in managing and handling risk, in particular after the recent financial crisis. This is clearly stated in Turnbull (1999) and in the recent Corporate Governance Code (2010). Therefore, the findings of this study may be useful for the regulatory bodies and corporate governance authorities, e.g., Financial Reporting Council (FRC), where the empirical findings can be used when developing or modifying the governance recommendations on the board structure.

The findings of this study document a negative relationship between board size and corporate risk. This implies that the firm's shareholders enjoy more benefits and their value is enhanced if the firm has a smaller board. These findings are consistent with the recent UK recommendations (2010) on board size. The UK governance code requires that the board size should not be too large. The (2010) UK code in section B (p.12) states that: "*The board should be of sufficient size that the requirements of the business can be met and that changes to the board's composition and that of its committees can be managed without undue disruption, and should not be so large as to be unwieldy*" Therefore, compliance with the code's requirements is expected to enhance and maximise the shareholders' value and improve the internal governance quality.

Regarding the board independence, the (2010) UK code recommends that at least half of the board should be non-executive directors as those directors limit the managerial opportunistic behaviour and work in line with shareholders' interests. Including more non-executive directors is expected to enhance more risky investment choices and moderate the executives' risk-aversion behaviour. The findings of this study indicate that the non-executive directors on the UK boards are found to play an inverse role through reducing corporate risk.

This negative effect suggests that those independent directors may work in line with regulators through more compliance with rules and regulations. The study shows that the negative effect of non-executive directors was stronger in the financial sector, where there are definitely more regulations. Thus, the compliance with respect to the ratio of non-executive directors on the board may not necessarily enhance the shareholders' value through taking more risk but it may protect firms against irresponsible managerial risk taking as well as from losses and failure. The focus of the corporate governance code may take into consideration not only the number of non-executive directors on the board but also it should consider their qualifications and skills, which may enhance their ability for better evaluation of investment decisions.

Finally, the findings in both sectors suggest that combining the titles of CEO and chairperson of the board increases the power concentration and negatively affects corporate risk. These findings provide support for the UK code recommendations, where the separation of these titles is recommended. Therefore, the compliance in this regard is expected to improve the internal governance quality and better serve the shareholders' interests.

The findings of this study contribute to the literature that investigates the effect of females in the boardroom. This study offers empirical evidence that gender-based differences in the corporate risk taking and the firm value creation have important implications. The positive association between female directors and corporate risk taking suggests that firms should seek to increase the representations of female directors on their boards. Further, the firms also should make efforts to help females to reach such high leadership positions through preparation and providing opportunities. The findings in our research support the notion of Brammer et al. (2007), who describe female representation on corporate boards as "*equality of representation not as a means to an end, but as a desirable end in itself* " (Brammer et al. 2007, p. 395).

These findings have important implications for the regulators and corporate governance advocators. The positive effect of female directors with respect to the corporate risk taking provides support to the regulators who legislate and require specific quotas for female representation on corporate boards in countries such as Norway, Spain, Germany, Belgium and the Netherlands. The findings of our study support this, in

which it is not only the idea of social equality but also the economic effect of female directors on the firm's outcomes and value creation. Moreover, the results provide support to the UK Corporate Governance Code (2010) that recommends all firms to increase board diversity in terms of gender.

7.4 Contributions

The recent financial crisis 2007-2009 shaped a turning point in the corporate governance studies. In the aftermath of the recent crisis, many observers and regulators claimed that the board of directors was being subject to some responsibility for firms' failures and losses. More importantly, the emphasis was on the role of the board with respect to corporate risk taking. In the UK, the recommendations of the corporate governance code placed risk management as a priority aspect for the board of directors. The corporate governance codes were modified to emphasise the importance of managing risk taking in both financial and non-financial sectors (UK Corporate Governance Code 2010; Walker Report 2009). Furthermore, due to the high pressure from social groups and the media to increase the representation of female directors on corporate boards, the UK governance code responded, and the recent governance code (2010) recommends more gender diversity on the corporate boards. This study aimed to examine the effect of board structure and female directors' representation on the UK corporate risk taking over the period 2003-2012.

This study provides several important contributions with regard to the board structure and female directors' risk-taking relationships. First, in the corporate governance literature, the board of directors had been extensively studied with corporate value. However, very few studies examine this relationship with respect to corporate risk taking (Adams et al. 2005; Cheng 2008; Erkens et al. 2012; Kim and Buchanan 2008; Lewellyn and Muller-Kahle 2012; Pathan 2009; Wang 2012). Therefore, this study contributes to the existing governance literature by assessing the relationship between board structure and corporate risk taking using a panel dataset from the UK market. The evidence from the UK is very limited since all the previously mentioned studies have been conducted in the US. However, due to the differences between the UK and the US that were highlighted in the first chapter, it can be argued that these differences may limit the generalisability of the findings.

Second, this study is the first in the UK that examines the effect of board structure on corporate risk in the financial sector. Financial institutions are usually excluded from corporate governance studies due to the special features and characteristics of the regulated industries. However, the importance of the financial sector in the stability of the whole economy in addition to the importance of risk-taking behaviour in such a sector, especially during the recent crisis, justifies the need for more investigation. Moreover, corporate governance in the financial institutions seems to be more important than in non-financial firms (Macey and O'Hara 2003). This is because the agency problem in the financial institutions exists between many different parties such as managers, shareholders, depositors, debtholders, etc. (Andres and Vallelado 2008) . The complexity in the financial institutions gives more importance to the corporate governance mechanisms, particularly the board of directors, as a control system. This study covers both the financial and non-financial UK public firms that are listed in the FTSE All-Share Index. Therefore, this study contributes to the corporate governance literature by providing empirical evidence on the relationship between board structure and corporate risk taking from the regulated industries.

Third, this study also contributes to the corporate governance literature on the relationship between female directors and corporate risk taking. The majority of previous studies have focused on corporate performance (Adams and Ferreira 2009; Campbell and Mínguez-Vera 2008; Carter et al. 2008). However, the evidence on how female directors are related to corporate risk is very limited. Additionally, the available evidence comes from outside the UK (e.g., Adams and Funk 2012; Berger et al. 2014; Lenard et al. 2014). The psychology and sociology studies indicate that males and females are different with respect to risk-taking behaviour (Croson and Gneezy 2009). Moreover, the previous literature investigates gender differences under risk using laboratory and gambling experiments (Eckel and Grossman 2008; Holt and Laury 2002; Schubert et al. 1999). The samples of these studies include females from the general population. Thus, understanding if the females who are in high leadership positions determine corporate risk is an important economic question. Therefore, this study examines how the female directors in both UK financial and non-financial sectors are related to corporate risk taking.

Fourth, this study contributes to the corporate governance literature on the effect of group composition on the firm's strategic outcomes. Examining if females who are already in high leadership positions in the business environment are different from those in the general population – who are usually stereotyped as more risk averse – may have several important implications. The findings of this study may serve as a motive for the policymakers to include female directors on corporate boards as a result of their competence and qualifications. In addition, it is not only a matter of social justice to increase female representation but also because of their economic value on corporate boards.

Fifth, given the importance of the recent financial crisis as an economic event that affects most corporations on a global scale, this study contributes to the literature through providing empirical evidence on the relationship between board structure, female directors on the board and corporate risk taking during the recent financial crisis. The study examines this relationship for both the financial and non-financial sectors in three sub-periods. These periods are: pre-crisis period (2004-2006), crisis period (2007-2009) and post-crisis period (2010-2012).

Finally, given that the board structure variables are endogenously determined, using the traditional estimation methods may not yield consistent results. In this study, the main estimation method is system GMM. This dynamic technique is able to control for three types of endogeneity, i.e. unobserved heterogeneity, simultaneity and dynamic endogeneity. Wintoki et al. (2012) argue that this dynamic panel estimator provides "*valid and powerful instruments*" to mitigate endogeneity concerns. Therefore, this study contributes to the corporate governance literature by employing a dynamic panel estimator that mitigates the endogeneity problem and yields valid and consistent results.

7.5 Limitations

Although every effort was made to prepare this piece of research, this study is not without limitations. The findings of this study should be interpreted and explained in the light of these limitations. First, the sample of the study includes both the financial and the non-financial sectors. However, the sample selection process in both sectors depends on pre-set criteria, which means it is a non-random selection. For example, to

calculate the idiosyncratic risk the firm should have at least 36 months of consecutive returns in order to calculate such a measure. Although this criterion is consistent with the prior literature (Cheng 2008; Florackis et al. 2011), it led to excluding firms that did not match and thus reduced the sample size. Likewise, to apply the dynamic estimation method system GMM only firms with at least five consecutive years of observations (Florackis and Ozkan 2009a) were selected.

Second, the data collection process in this study relies on several sources. For instance, the accounting and market data were extracted from WorldScope and DataStream Databases respectively. The corporate governance data were extracted using the BoardEx database. Using BoardEx was a challenge due to the nature of data management in this database. BoardEx is unlike WorldScope or DataStream databases because extracting data from BoardEx is almost manual. This takes a long time since this study covers both financial and non-financial sectors and the sample also covers ten years. Moreover, some firms have no data available on the BoardEx database, which required using the annual reports in some cases for specific years. Although this may increase the probability of errors in collecting this data, limited access to other electronic databases for governance data made BoardEx the only available electronic source for the researcher. However, it is worth noting that BoardEx has been used in many recent governance studies as a reliable source of data (Erkens et al. 2012; Minton et al. 2014).

Third, the estimation method in this study employs dynamic panel estimator system GMM to control for endogeneity. This method uses the lagged value of the risk measures and firm financial characteristics as instruments for the endogenous variables. However, Chapter 6 examines the effect of board structure on corporate risk during the recent financial crisis. The period of the study was divided into three sub-periods, i.e. pre- (2004-2006), crisis (2007-2009) and post-crisis (2010-2012) periods. Each period includes three years, therefore this classification, which is consistent with prior literature, limits us from using the dynamic estimator system GMM.

As mentioned before, for system GMM to work it needs at least five consecutive years of observations. Accordingly, in Chapter 6 we run GLS (Pathan 2009). It is worth noting that the empirical strategy in this chapter controls only for unobserved

heterogeneity and simultaneity but not for the dynamic one. Thus, the result in this chapter should be interpreted with caution due to the effect of dynamic endogeneity.

7.6 Key Areas for Future Research

The findings of this study provide evidence that the board structure and the presence of female directors are determinants of corporate risk taking in the UK. However, other governance features that may determine corporate risk taking are not covered by this research. One attractive avenue for future research is investigating other characteristics of the board of directors that could affect corporate risk taking. For instance, in the financial sector, one of the debated issues in the aftermath of the recent crisis is the remuneration system. The design of the remuneration system, particularly in the financial institutions, motivates the executives to exhibit excessive risk taking and was considered a cause of the crisis. Although this study controls for CEO ownership, future research may include other components such as bounces and stock options. In addition, future research may consider the ownership of the non-executive directors on the board and examine the ownership level with respect to corporate risk taking.

This study has been completely based on a quantitative method to examine the relationship between board structure, female representation on the board and corporate risk taking. This method is more relevant in order to answer our research questions as prior literature employs secondary data. However, an interesting point for future research is to examine these relationships using a qualitative method such as interviews with directors on the board. These interviews may be more informative and enhance our understanding of the perceptions of male/female directors with respect to the risk-taking behaviour. In addition, using mixed methods, i.e. quantitative and qualitative, in examining these relationships would potentially enhance the validity of the results and contribute to our understanding in this field.

Another opportunity arising for future research would be conducting a comparative study between the UK firms and firms in other countries in terms of the effect of board structure and female directors on corporate risk taking. Given the differences that exist in governance and legal systems across countries, it would be interesting, for example, to compare how these relationships may be affected due to these differences. For

example, in the UK the corporate governance code is voluntary and works on the basis of “comply or explain” while this is not the case in the US, where most of the governance practices are compulsory. Another interesting point may also be related to a comparative study between one-tier and two-tier board systems. These comparative studies may be helpful to indicate how the board of directors may respond in different environments and under different legal and governance systems.

Finally, in the UK the recent Corporate Governance Code (2010) recommends increasing the female representation on corporate boards to gain from diversity. Future research may conduct a comparative study between the UK and other countries that state a fixed and legal quota for female directors, such as Norway. The findings of such studies may be useful for regulators and policymakers to include females on the corporate boards more formally through clear legislations. Another interesting point for future research related to the gender diversity on the board, is to look for female directors’ classification i.e., executives, non-executives and CEO’s and how each one affect corporate risk taking. In this study the main source of governance data is BoardEx database where such classification is not available.

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